

Papers from Dr. Th. Mortensen's Pacific Expedition  
1914—16.

XX.

Echinoderms of New Zealand and the Auckland-  
Campbell Islands.

II. Ophiuroidea.

By

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(With Pls. III—IV.)

The first Ophiuroid known from New Zealand was *Pectinura maculata*, described by Verrill<sup>1)</sup> in 1869 under the name of *Ophiarachna maculata*. In Hutton's "Catalogue of the Echinodermata of New Zealand" (1872) in all 5 species are mentioned, viz.

*Ophiothrix coerulea* n. sp.

*Ophionereis fasciata* n. sp.

*Ophiactis nigrescens* n. sp.

*Ophiura maculata* Verrill

*Ophiura cylindrica* n. sp.

To this list Hutton adds in 1878<sup>2)</sup> one more new species, *Amphiura parva*. In 1877 E. A. Smith<sup>3)</sup> added another Ophiurid to the New Zealand fauna, viz. *Ophiopteris antipodum*, representing a new generic type.

Not counting a few deep-sea forms, dredged by the "Challenger" and the "Gazelle" off New Zealand, all additions to the New Zea-

1) A. E. Verrill. On new and imperfectly known Echinoderms and Corals. Proc. Boston Soc. Nat. Hist. Vol. XII. p. 388.

2) F. W. Hutton. Notes on some New Zealand Echinodermata, with descriptions of new species. Trans. N. Z. Inst. XI. p. 305.

3) E. A. Smith. Description of a new form of Ophiuridae from New Zealand. Ann. Mag. Nat. Hist. 4. Ser. XIX. p. 305.

land Ophiuroid fauna for the next nearly 30 years are due solely to the efforts of H. Farquhar, who in a series of papers, published mainly in the Transactions of the N. Z. Institute, describes several species new to science from New Zealand waters, corrects former identifications of New Zealand species, records species hitherto not found in New Zealand waters or rejects species wrongly included in the New Zealand fauna.

In 1894 he describes *Amphiura rosca* n. sp. from Wellington Harbour. In 1895 *Ophiomyxa australis* Ltk. is recorded from New Zealand, and Hutton's *Ophionereis fasciata* is declared identical with the Australian *Ophionereis Schayeri* M. & Tr., while *Ophiothrix coerulea* Hutton is rejected from the New Zealand fauna, being from Fiji. In 1897<sup>1)</sup> Farquhar describes the new species *Amphiura pusilla*, and *Amphiura elegans* (= *Amphipholis squamata*) is recorded from New Zealand. His next paper, 1898,<sup>2)</sup> contains only the data up to that time, giving no new additions to the New Zealand Ophiuroid fauna. Next follow the descriptions of these new species: *Ophioplocus Huttoni* (1899), *Ophiocreas constrictus* (1900), *Amphiura aster* (1901), *Ophiactis nomentis* (1907), *Ophiocoma bollonsi* (1908) and finally *Amphiura arenaria* (1913).

In 1907 Koehler described in his "Revision de la collection des Ophiures du Muséum d'histoire naturelle de Paris"<sup>3)</sup> an Ophiurid, *Amphiura praelecta*, from Campbell Island and another, *Amphiura basilica*, from East Cape, New Zealand, both of them brought home by M. Filhol, from the Transit of Venus-Expedition in 1874, but which had remained undescribed till then. — The Trawling Expedition of the New Zealand Government, 1907, brought to light two more Ophiurids new to science, viz. *Astrotoma Waitei* and *Amphiura noræ*, described by Benham in 1909;<sup>4)</sup> no other forms were added by this expedition to the New Zealand Ophiuroid fauna.

<sup>1)</sup> H. Farquhar. A contribution to the history of New Zealand Echinoderms. Journ. Linn. Soc. London. Zoology. XXVI. p. 186—198.

<sup>2)</sup> H. Farquhar. On the Echinoderm Fauna of New Zealand. Proc. Linn. Soc. N. S. Wales. 1898.

<sup>3)</sup> Bull. sc. de la France et de la Belgique. XLI.

<sup>4)</sup> Scientific Results of the New Zealand Government Trawling Expedition 1907. Echinoderma, by W. B. Benham. Rec. Canterbury Mus. Vol. I. No. 2. 1909.

The same holds good of the Expedition to the Subantarctic Islands in 1907, which found only one species of Ophiurids, in Carnley Harbour, Auckland Islands. In his report on the Echinoderms of this expedition Benham<sup>1)</sup> lists this species as *Amphiura squamata*, proving at the same time Hutton's *Amphiura parva* to be only a synonym of this species.

A few more additions to the Ophiuroid fauna of New Zealand are found in H. L. Clark's "Catalogue of Recent Ophiurans" 1905,<sup>2)</sup> viz. *Ophiocormus notabilis* and *Ophiozonoida picta*, both collected by Farquhar; further the New Zealand *Ophiomyxa* is described as a new species, *O. brevirima*. — Lastly F. Jeffrey Bell in 1917 in his Report on the Echinoderms of the British Antarctic ("Terra Nova") Expedition adds four new Ophiuroids to the New Zealand Fauna, viz. *Ophiothrix* sp., *Astroporpa Wilsoni*, *Astroschema elegans* and *Astrotoma benhami*, all dredged off the North of New Zealand, the three latter being new to science.

In the present paper 9 new species and 3 new varieties are described, namely:

- Ophiocreas longipes*
- Gorgonocephalus chilensis*, var. *novæ-zelandiæ*
- Ophiacantha vilis*
- Amphiura spinipes*
- "    *alba*
- "    *hinemoæ*
- "    *amokuræ*
- "    *annulifera*
- "    *eugeniæ*, var. *latisquama*
- Ophionephthys stewartensis*
- Ophiactis profundis*, var. *novæ-zelandiæ*
- Pectinura gracilis*

Two more species, *Astroschema* sp. and *Amphiura* sp. are probably new, but are too young to be identified with certainty.

The following 5 species are recorded as new to the New Zealand fauna:

1) The Subantarctic Islands of New Zealand. 1909. Art. XIII. W. B. Benham. The Echinoderms, other than Holothurians, of the Subantarctic Islands of New Zealand.

2) Mem. Mus. Comp. Zool. Harvard College. Vol. XXV. 1915.

- Ophiothrix oliveri* Benham  
 „ *aristulata* Lyman  
*Ophiactis hirta* Lyman  
*Amphiura magellanica* Ljungman  
*Amphiocnida pilosa* (Lyman)

Further it is proved that Hutton's *Ophionereis fasciata* is a valid species, not identical with the Australian *Ophionereis Schayeri*, while, on the other hand, *Ophiactis nomentis* Farquhar is identical with the Australian *Ophiactis resiliens* Lyman. Also Farquhar's *Amphiura arenaria* is shown to be identic with his *Amphiura aster*. Finally Hutton's *Ophiactis nigrescens* is rejected from the New Zealand fauna, the examination of the type having led to the result that it is a specimen of *Ophiocoma schoenleini* M. & Tr. from the Fiji Islands.

The following is then a corrected list of the New Zealand Ophiuroids, not including those from the Kermadec Islands and from the Deep-sea off New Zealand.

1. **Ophiocreas constrictum** Farquhar
2. „ **longipes** n. sp.
3. **Astrotoma Waitei** Benham
4. „ **Benhami** F. Jeffr. Bell
5. **Astroporpa Wilsoni** F. Jeffr. Bell
6. **Astroceras elegans** (F. Jeffr. Bell) (= *Astroschema elegans* F. Jeffr. Bell)
7. **Astroschema** sp.
8. **Gorgonocephalus chilensis**, var. **novæ-zelandiæ**, n. var.
9. **Ophiomyxa brevirima** H. L. Clark (non = *Ophiomyxa australis* Ltk.)
10. **Ophiacantha vilis** n. sp.
11. **Ophiothrix aristulata** Lyman
12. „ **Oliveri** Benham  
( „ *coerulea* Hutton not New Zealand)
13. **Ophiocormus notabilis** H. L. Clark
14. **Ophiocoma Bollonsi** Farquhar
15. **Ophiopteris antipodum** E. A. Smith
16. **Ophiactis resiliens** Lyman (= *Ophiactis nomentis* Farquhar)
17. „ **hirta** Lyman

18. **Ophiactis profundi**, var. **novæ zelandiæ** n. var.  
(*Ophiactis nigrescens* Hutton not New Zealand, = *Ophiocoma schoenleinii* M. & Tr.)
19. **Amphiura magellanica** Ljungman
20.     "     **spinipes** n. sp.
21.     "     **præfecta** Koehler
22.     "     **aster** Farquhar (= *Amphiura arenaria* Farquhar)
23.     "     **noræ** Benham
24.     "     **rosea** Farquhar
25.     "     **eugeniæ**, var. **latisquama** n. var.
26.     "     **amokuræ** n. sp.
27.     "     **alba** n. sp.
28.     "     **hinemoæ** n. sp.
29.     "     **annulifera** n. sp.
30.     "     **pusilia** Farquhar
31.     "     sp.
32. **Amphiocnida pilosa** (Lyman)
33. **Amphioplus basilicus** (Koehler)
34. **Ophionephthys stewartensis** n. sp.
35. **Amphipholis squamata** (D. Ch.) (= *Amphiura parva* Hutton)
36. **Ophionereis fasciata** Hutton (**non** = *Ophionereis Schayeri* M. & Tr.)
37. **Ophiozonoida picta** H. L. Clark
38. **Ophioplocus Huttoni** Farquhar
39. **Pectinura cylindrica** (Hutton)
40.     "     **gracilis** n. sp.
41.     "     **maculata** (Verrill)

As the number of species of Ophiurids recorded in the "Index Faunæ Novæ Zelandiæ" (1904) is 36, the present list, numbering 41 species, would appear to represent a small progress only in our knowledge of the New Zealand Ophiurid fauna. An analysis of the list of the „Index” will, however, give a somewhat different impression. Out of the list of the „Index” no less than 22 species are Deep-sea forms, and one is known from the Kermadec Islands only. These species might well be added to the present list; when omitted here it is not because they are not regarded as belonging rightly to the New Zealand fauna, but only because

it is out of the scope of this work to treat the Deep-sea forms. Accordingly, only the remaining 13 species of the „Index“ are to be compared with those of the present list, and, moreover, one of these 13 species, *Amphiura parva* is a synonym of *Amph. elegans* (= *Amphipholis squamata*). Thus the number of Ophiurids known from the New Zealand seas has been raised from 12 to 41 in the course of the last twenty years. Rather a noticeable increase!

That the list is still far from complete is indubitable. We may especially feel confident that many more forms will be found in the sea to the North of New Zealand, which appears to be an eminently rich and interesting faunistic area. Also the Cook Strait, which has yielded the first *Gorgonocephalus* and the first *Ophiacantha* to the New Zealand fauna, as well as the rare *Ophiactis hirta*, will, no doubt, afford lots of interesting forms, when once a thorough survey of its bottom fauna will be made. Even the purely littoral fauna may well be expected to yield new forms, seeing that such interesting species as *Ophiozonoida picta*, *Ophiocormus notabilis* and *Amphiura annulifera* have been found there within the last few years.

From the Auckland- and Campbell Islands were hitherto known only two species of Ophiurids, viz. *Amphiura præfecta* Koehler, brought home from the Transit of Venus-Expedition by Filhol, and *Amphipholis squamata*, the only species collected by the Expedition to the Subantarctic Islands in 1907. Besides these two species I have found there *Ophiomyxa brevirima*, *Amphiura magellanica*, *Amph. amokuræ* and *Amphioplus basilicus*. I do not think that those 6 species are all that are to be found there; especially I have no doubt that dredgings in the sea off these islands will result in adding a fair number of Ophiurids — and other Echinoderms — to their fauna.

A very noticeable feature in the New Zealand Ophiuroid fauna is the large percentage of Amphiuroids, 17 out of 41 — and almost equally noticeable is the total absence of any *Ophiura*-species (sensu lat.), a group otherwise of worldwide occurrence. It is hardly conceivable that it should really be totally absent from New Zealand waters, and considering the fact that only quite recently the first *Ophiothrix* and the first *Ophiacantha* have been found in those seas

it may not seem too fanciful to expect that also the *Ophiura*-group will ultimately prove to be represented there.

None of the new species described in this paper are of exceptional morphological interest. A noteworthy discovery is the viviparity of *Ophiomyxa brevirima* and of *Amphiura annulifera*, the latter being also hermaphroditic. Very interesting is also the find of a parasitic Copepod of the genus *Cancerilla* on *Amphipholis squamata*; while the Ophiurid cannot be distinguished from the specimens living in the European seas (and, apparently, all over the world), the parasite is specifically quite distinct from the *Cancerilla tubulata* infesting specimens in the European seas — (according to kind information from Mr. K. Stephensen, who is preparing a report on the Crustaceans collected at the Auckland-Campbell Islands).

The material upon which the present report is based was collected mainly by the author himself during his visit to New Zealand and the Auckland-Campbell Islands in 1914—15. Further Mr. W. R. B. Oliver, the Dominion Museum, Wellington, has done me the favour partly of presenting me with material from his own collection and partly of sending me some Ophiurids from the collections of the Wellington Museum, among which the types of "*Ophiactis nigrescens*" Hutton, *Pectinura cylindrica* (Hutton), *Astrotona Waitei* Benham, cotypes of *Amphiura arenaria* Farquhar, *Ophiothrix oliveri* Benham, and some material from the Cook Strait, collected by Mr. Hazelwood, comprising *Gorgonocephalus chilensis*, var. *novæ-zelandiæ*, *Ophiacantha vilis* and *Ophiactis hirta*, the two former new to science, the latter new to the New Zealand fauna. Also to Professor W. B. Benham, Otago, I am greatly indebted for important material, comprising the type of Hutton's *Amphiura parva*, a cotype of *Ophiothrix oliveri* Benham, Var. and a specimen of *Ophiocreas constrictum* Farquhar from the type-locality. I beg herewith to tender my cordial thanks to the two said gentlemen. Finally, I beg to express my great indebtedness to the Authorities of the British Museum, London, for leaving me for study the Ophiurids from New Zealand seas, collected by the "Terra Nova" Expedition, allowing these specimens to be sent to Copenhagen. I had an opportunity of a rather cursory examination of these species during my visit to the British Museum in 1920, and of seeing

that the identifications due to Bell are as phantastic as might be expected from the knowledge of the other later contributions to science from the hand of this remarkable author. His *Pectinura* sp. is *Ophiozonoida picta*, his *Ophiomyxa brevirima* is *Ophiocreas constrictum* Farquhar, while his *Ophiocreas constrictum* is the new species described here as *Ophiocreas longipes* n. sp.; alone his *Ophiothrix* sp. is correctly identified as to the genus. Fortunately, Bell did not care to trouble himself with the three other species in the collection but sent them to Professor Benham for identification. Thus it happened that the three species *Astroporpa Wilsoni*, *Astroschema elegans* and *Astrotoma benhami* are correctly identified, thanks to Prof. Benham (apart from *Astroschema elegans*, which should rather be referred to the genus *Astroceras*); but the descriptions supplied by Bell are very insufficient, and likewise Bell did not take the trouble of having figures made of these three new species, while he gives several figures of the old and well known species *Cycethra verrucosa* and *Ophiosteira antarctica*, in order to show their supposed great variability. Through the courtesy of the Authorities of the British Museum I have been able to supply the necessary figures of these species and to give complete descriptions of them.

Upon the whole, I have made a point of giving, so far as possible, accurate and detailed figures of all the species, those new to science as well as those not hitherto figured, and of supplying necessary corrections to such figures as were previously published. I have confined myself to giving ink-drawn textfigures (excepting the Euryalids), as, in my opinion, photographs of such forms, where the exact outlines of the various plates are of supreme importance for the identification, are altogether too often more or less useless, and rather tantalizing for the student who tries, often in vain, to make out on those figures the characters mentioned (or perhaps not mentioned) in the descriptions. Instances of this are found also in the literature concerning the New Zealand Ophiurids.

May I hope to have facilitated through these efforts the correct identification of New Zealand Ophiurids, and to have given local investigators some stimulus to a further study of this highly interesting fauna, a study which cannot fail to bring many interesting new facts to light, not only additions to this fauna but also in-



creased knowledge of the biology of the forms already known to occur in those seas.

1. *Ophiocreas constrictum* Farquhar.

Pl. IV. Figs. 4-5.

*Ophiocreas constrictus*. H. Farquhar. 1900. On a new species of Ophiuroidea. Trans N. Z. Inst. XXXII. p. 405.

— *constrictum* H. Lyman Clark. 1905. Cat. Rec. Ophiurans, p. 178.

— *phanerum* — — 1916. Biological Results ... "Endeavour". Report on the Sea-Lilies .... p. 79. Pl. XXXIII. 1-2.

*Ophiomyxa brevirima*. F. Jeffr. Bell. 1917. British Antarctic ("Terra Nova") Exp. 1910. Echinoderma. Zool. IV. p. 7.

Non: *Ophiocreas constrictus*. F. Jeffr. Bell. 1917. British Antarctic ("Terra Nova") Exp. 1910. Echinoderma. p. 7. = *Ophiocreas longipes* n. sp.

Having had a specimen of this species from the type locality, Dusky Sound, kindly sent me for examination by Professor Benham, I must say that I do not see how this species could be distinguished from the Australian form described by H. L. Clark as *Ophiocreas phanerum*. According to the descriptions it would appear that *O. constrictum* differs from *O. phanerum* in the character of the skin, which is stated to be covered with minute papillæ and small pores in the former, while in the latter it is perfectly smooth. I cannot, however, ascribe much importance to this character. In one of two specimens of the Australian form at hand I find in places similar small papillæ, though not quite so distinct as in the New Zealand specimen. As regards the pores, I do not think them anything but artefacts, due either to preservation or to some sort of damage done to the type specimen by the dredging. In the specimen at hand I can hardly see any indication of pores, and what is seen is certainly due to some damage. As no other differences are found, I do not see any reason for distinguishing the Australian from the New Zealand form.

To the descriptions given by Farquhar and Clark I may add that the lateral plates do not meet in the ventral midline, but are separated by very well developed ventral plates (Fig. 1.2). This fact has a rather important bearing on the systematic position

of this species. As pointed out by Matsumoto<sup>1)</sup> a main character of the *Astrochematinae* is the joining of the lateral plates in the ventral midline of the arm, in contradistinction to the *Trichasterinae*, in which the lateral plates are separated by the ventral plates. According to this character the present species is no *Ophiocreas* at all, but should be included in the subfamily *Trichasterinae*, repre-

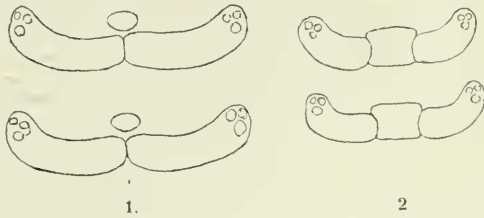


Fig. 1. The ventral plates and lateral plates of two consecutive armjoints of *Ophiocreas longipes* (1) and *Ophiocreas constrictum* (2). The small round spots on the outer end of the lateral plates indicate the grooves for the insertion of the armspines. <sup>2/3</sup>.

sented a new genus, the nearest ally of which would appear to be *Astroceras*. But then it differs from the *Trichasterinae* in the lateral plates not projecting ventrally like hanging rods, which is also a character of the *Trichasterinae*. Regarding the anatomical characters pointed out by Matsumoto as distinguish-

ing the two said subfamilies, I have no material for examining them in the present species. The matter is rather puzzling, and as it would hardly be possible to reach a definite solution of the systematic problems raised by this form without going into a very detailed study of the whole family *Trichasteridae*, for which I have neither material nor time, I shall provisionally leave the present species within the genus *Ophiocreas*, in spite of the marked difference in the lateral and ventral plates.

Also *Ophiocreas adhærens* Studer has the sideplates separated by well developed ventral plates. This species, apparently, is closely related to *O. constrictum*; I should, indeed, not be surprised at all, if it ultimately turned out to be identical with that species. From the description given by Studer<sup>2)</sup> this would appear rather im-

<sup>1)</sup> H. Matsumoto. A new classification of the Ophiuroidea; with descriptions of new genera and species. Proc. Acad. Nat. Sc. Philad. Vol. LXVII. 1915 p. 51.

<sup>2)</sup> Th. Studer. Verzeichniss d. während d. Reise S. M. S. „Gazelle“ um die Erde 1874—76 gesammelten Asteriden und Euryaliden. Abh. d. Kgl. Preuss. Akad. d. Wiss. Berlin, a. d. Jahre 1884.

probable, it is true, some very definite characters being assigned to his *O. adhærens*, viz. large, conspicuous mouthshields, the presence of six granules, in two series, above the second tubefeet and of a hook inside the two tentacle scales, from about the middle of the arm; finally the tentacle scales are stated to begin only at the fourth pair of tubefeet. Having had one of Studer's cotypes from the Berlin Museum for examination, I must state that — in this specimen, at least (and it corresponds very well with the figures given by Studer, so that there would not seem to be any reason for thinking that it might be a different species confounded with the true *adhærens*) — there are no grains at the second tubefeet, no hook inside the tentacle scales in any part of the arm, and the tentacle scales begin at the third pair of tubefeet (not counting the oral tubefeet). (In Studer's figure 11. b. they are even represented as beginning at the second pair!). Finally, the mouth shields are not at all large and conspicuous, on the contrary, quite small and inconspicuous, situated in the very outermost corner between the large adoral shields. What has been taken by Studer to be the oral shields are, in fact, the adoral shields (Comp. his fig. 11. b., Pl. IV). The only noteworthy difference which I find to exist between this specimen and the young specimen of *O. constrictum* from off the North of New Zealand (see below), which is of nearly the same size, is the somewhat greater length of the bursal slits in *O. adhærens*. The very distinctly jointed appearance of the arms and the prominence of the radial shields in *O. adhærens* would appear to be due to the specimen having been half dry. In any case, *O. adhærens* and *O. constrictum* must be very nearly related: whether they are really different species or identical, is a question which can only be settled on a close study of a much larger material than at present available.

The young specimen figured in Pl. IV, figs. 4—5, is the one which Bell (Op. cit.) identified as *Ophiomyxa brevissima* (evidently only because it agrees with the name in its short genital slits; the resemblance to an *Ophiomyxa* would be hard to find). It agrees, upon the whole, so well with *Ophiocreas constrictum* that I hardly have any doubt of its being a young specimen of this species. (It measures 8 mm diameter of disk, ca. 100 mm length of arms). Only the colour is different, light-brown, while *O. constrictum* is

deep red-purple. But as H. L. Clark states the young specimens of his "*Ophiocreas phanerum*" to be "somewhat lighter", I do not think this colour difference sufficient for regarding this specimen as representing a separate species. At any rate, until more material shall be available, it may be regarded as identical with *O. constrictum*. — It was taken East of North Cape, in a depth of 70 fathoms.

*O. constrictum* must then be expected to occur in the seas all round New Zealand as well as in the East Australian waters.

## 2. *Ophiocreas longipes* n. sp.

Pl. III.

*Ophiocreas constrictus* Farqh. F. Jeffer. Bell. 1917. British Antarctic ("Terra Nova") Exp. 1910. Echinoderma. Zool. IV.<sub>1</sub>. p. 7.

Diameter of disk 25 mm. Arms of unequal length, the longest ca. 600 mm, the shortest ca. 400 mm. Width of arm near disk 6.5 mm, height 7 mm. Disk and arms covered with a rather thin, completely smooth skin, which forms some longitudinal folds on the arms. Radial ribs narrow, meeting in the centre of the disk. Mouthangles with 2—3 rounded grains adjoining the teeth; the number of these latter could not be ascertained, the mouth being tightly closed. Genital slits 5—6 mm long, deeply sunk, nearly parallel. Tentacle pores small, the first pair without papillæ; the following 4—7 pairs carry one papilla, beyond these there are two papillæ to each pore. One of the arms shows a somewhat abnormal arrangement of the tentacles on the second and third joint, and a corresponding abnormal arrangement of the papillæ. The inner papilla (or arm spine) gradually becomes elongated and clubshaped, its length not exceeding 3.5 mm. The outer papilla is about  $\frac{1}{2}$ — $\frac{2}{3}$  that length, not clubshaped. The lateral plates join in the ventral midline, a very small, oval ventral plate generally lying in front of them (Fig. 1.1); in some joints it may, however, be lacking. (The shape of the lateral and ventral plates discernible only on dissolving the skin e. g. by means of hypochlorite of sodium).

The single specimen was taken 25 miles off Three Kings Isl., in a depth of 300 fathoms.

This species is, evidently, closely related to *Ophiocreas siboga* Koehler, from which it is distinguished through the grains on the

sides of the mouth-edges and through the arms being considerably longer. Further the papillæ, or armspines, afford a characteristic difference (Fig. 2). In *O. sibogæ* the outer spine is almost as long as the inner one, the latter being provided with some larger, straight thorns on the adradial side in its outer part; in *O. longipes* the outer spine is, at most, two thirds the length of the inner one, which latter is provided in its outer part, on the adradial side, with a great number of strong, curved thorns. To this thorny part of the inner spine is attached a gland which is much larger in *longipes* than in *sibogæ*; the more or less distinct, claviform shape of this spine is mainly due to the different development of this gland, which appears to be of very common occurrence in Euryalids, and the secretory function of which

has no doubt some important bearing on the biology of these forms.

The greater length of the arms in *O. longipes* might seem to be no real difference from *O. sibogæ*, since H. L. Clark in his report on the „Endeavour“ Echinoderms (p. 80) records among his specimens of the latter species from the Bass Strait and the Great Australian Bight (80—300 fms) one of the same size and arm-length as the New Zealand specimen here made the type of *O. longipes*. Most probably, however, Clark's specimens are in reality not *O. sibogæ*, but *O. longipes*. Clark, himself, expresses some doubt as to the correctness of identifying the Australian specimens with *O. sibogæ*; I would therefore think it probable that they do really belong to the New Zealand species. At least, the statements resting on these specimens cannot afford the proof of the identity of the New Zealand species with *O. sibogæ*, and, for the

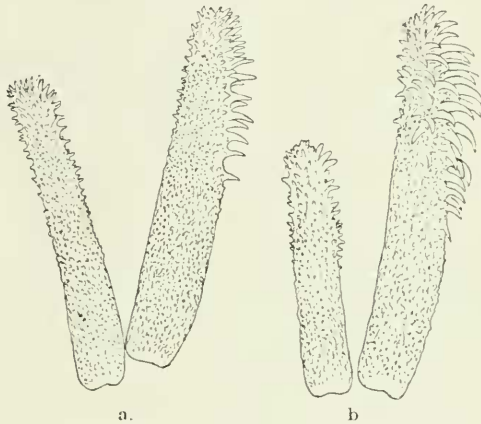


Fig. 2 Armspines (papillæ). from about the middle of the arm, of *Ophiocreas sibogæ* (a) and *Ophiocreas longipes* (b). <sup>12</sup>/<sub>1</sub>.

present, the only safe course seems to me to be that of regarding the New Zealand form as a distinct species.

That this species is not identical with *Ophiocreas constrictum* Farquhar, to which it was referred by Bell, is very easily seen. The fact alone that the tentacle papillæ appear from the second joint (in *O. constrictum* from the third joint) is sufficient to prove these forms to be quite distinct, this character being of special importance within this genus.

### 3. *Astrotoma Waitei* Benham.

Pl. IV. Fig. 2.

*Astrotoma Waitei*. W. B. Benham. 1909. Scientif. Res. N.Z. Governm. Trawling Exp. 1907. Echinoderma. Rec. Canterb. Mus. 1.2. p. 19. Pl. IX. 1—6.

Two specimens of this species having been lent me for examination, by Mr. Oliver and Prof. Benham, I take the opportunity of giving a photographic figure of it, which may not be superfluous, as the drawings by Prof. Benham (Op. cit.) cannot, of course, give all the details so exactly as does a photo.



Fig. 3. Hook from arm of *Astrotoma Waitei*, <sup>105/1</sup>.

To the very careful description given by Benham I would only add that the rounded "scales", stated to cover the upper surface of the disk, are more appropriately designated as grains. The segmented appearance of the dorsal side of the arms is very differently developed in the two specimens examined by me — in one the depressions are very distinct, in the other, the one photographed, they are so narrow as to be hardly distinguishable. — The hooks are provided with one small tooth below the long, pointed endtooth. (Fig. 3).

When Benham speaks — here and in other Ophiurid-descriptions — of the "adradial" plates, the meaning is, of course, the radial shields.

### 4. *Astrotoma Benhami* Bell.

Pl. IV. Figs. 6—7.

*Astrotoma Benhami*. F. Jeffr. Bell. 1917. Brit. Antarctic „Terra Nova“ Exped. 1910. Echinoderma. Zoology. IV.1. p. 8.

Bell states that there is only a single specimen of this species. In fact there are 9 specimens, ranging in size from 10 to 14 mm diameter of disk. One specimen has the arms well extended; they reach a length of ca. 60 mm; as the point is broken the true length is somewhat greater, probably some 80 mm total.

To the very deficient description not accompanied by figures, given by Bell, I shall add the following remarks, also supplying the necessary figures.

The tubercles, which cover the disk completely, leaving no distinct traces of the radial shields, are rounded, perfectly smooth, smaller in the middle of the disk, increasing in size towards the base of the arms; rarely they continue a little way out on the dorsal surface of the arms. The interradial spaces on the oral side generally carry a few similar, but somewhat smaller tubercles; otherwise they are covered with fine grains. Also the underside of the arms and the oral frame are covered by rounded grains, generally slightly larger than those of the interradial spaces. Along the edge of the mouthframe there is mostly a series of larger tubercles, forming something like a fence, separating the slightly sunken interradial space from the mouth frame. This transverse series of tubercles has much the appearance of being a continuation of the series of armspines. The genital slits are fairly large, some 2 mm long. The mouth edges carry each a cluster of spines or papillæ, which outwards gradually pass into the common granulation of the underside. This is perhaps what is meant by the statement of Bell that „the papillæ are encircled by well-marked granules which become spiniform towards the periphery“, a statement which does not appear very intelligible. The covering of the dorsal side of the arms is that typical of *Astrotoma* s. str.; it may only be pointed out that the double rings of hooks are complete from the base of the arm, at most the 1—3 proximal rings being interrupted in the dorsal midline. There are generally three short, thick, smooth armspines, slightly rough at the point. Now and then there may be only two spines on some consecutive joints. Towards the end of the arm the spines gradually assume the character of hooks.

This species appears to be most nearly related to *A. Murrayi* Lym. — No specimens are known besides those taken by the "Terra Nova".

From the other species of *Astrotoma* known from New Zealand waters, *A. Waitei* Benham, it is very easily distinguished through its much coarser granulation of the disk, through the number of armspines (8 in *A. Waitei*), as also through the rings of hooklets, which are divided in many small parts in *A. Waitei*.

### 5. *Astroporpa Wilsoni* Bell.

Pl. VI. Figs. 8-9.

*Astroporpa Wilsoni*. F. Jeffrey Bell, 1917. British Antarctic ("Terra Nova") Expedition 1910. Echinoderma. Zoology. IV.1. p. 7.

This species is very closely related to the Australian species, *A. australiensis*, described by H. L. Clark<sup>1</sup>). Only two characters, so far as I can see, distinguish it from the latter species, viz.: the grains covering the interradial spaces on the oral side are conical, slightly pointed in *A. Wilsoni*, perfectly smooth (or nearly so) in *A. australiensis*; the colour of the brown rings alternating with the white rings on the arms and the disk are pale brown in *A. Wilsoni*, dark brown, and accordingly much more conspicuous, in *australiensis*. Also the mouth papillæ are perhaps slightly shorter in the New Zealand- than in the Australian form. These differences are certainly rather small, but, if they prove constant, they may well justify regarding the two forms as distinct species. At least, it would not be correct to unite them into one species on the basis of the material available at present (the two specimens of the New Zealand form collected by the "Terra Nova" and a few specimens of *A. australiensis*, collected by the author in 1914 in the Australian seas).

Bell's statement that there is „a total absence of ornamentation from the plates, both of the arms and disc“ seems rather peculiar, since there are, upon the whole, no plates to be discerned either on the disc or the arms, only a general covering of grains of various character, as clearly set forth by Clark. Also the statement that „the armspines are numerous, very delicate, with minutely roughened surfaces“ is somewhat remarkable; their number amounts to 4-6 (only very exceptionally 7), which would

<sup>1</sup>) Scientific Results of the Trawling Expedition of H. M. C. S. "Thetis". Echinodermata. Mem. Austral. Mus. IV. 1909. p. 547. Pl. LIV.2.



not seem to be an insuperable number to count, and they are short, thick, flattened, ending in 2—4 distinct points, which could not easily be gathered from the description quoted. — Otherwise, I would refer to the description given by Clark of his *A. australiensis*, which — apart from the differences pointed out above — suits *A. Wilsoni* as well.

No other specimens known than those taken by the "Terra Nova". East of North Cape, 70 fathoms. Besides the two specimens on which Bell's description was based, there is also a young specimen, 4 mm diameter of disk, lying together with the specimens of *Ophiothrix aristulata*, as mentioned by Bell under his *Ophiothrix sp.* Its arms are so strongly coiled up that it is impossible to measure their length. The specimen shows the interesting feature of the 6 primary disk plates being distinct; they are, however, very small, and only through their darker colour to be distinguished from the grains. There is no trace of the radial shields. There are only two of the grain-covered transverse bars on the disk at the base of each arm, while in the grown specimens there are 4—5 of these bars on the disk. The genital slits have appeared, but are situated off the first armjoint (armspines), while in the adult specimens they lie between the third and fourth joint. A very considerable displacement must accordingly take place during growth.

#### 6. *Astroceras elegans* (Bell).

Pl. VI. Fig. 3.

*Astrochema elegans*. F. Jeffer. Bell. 1917. British Antarctic ("Terra Nova" Exped. Echinoderma. Zoology. IV.1. p. 7.

To the rather deficient description of this species given by Bell I may add the following remarks.

With "the five pairs of rows of prominent plates, which might at a superficial view be taken for radial shields" are evidently meant the white tubercles, which cover the radial shields; they are generally arranged in a very distinct series along each radial shield in the younger specimens, while in the larger specimens the arrangement becomes more irregular. Also the number of these tubercles is rather variable. The white tubercles continue a various distance on the arms, sometimes only on a few of the inner joints, sometimes forming regular rings nearly to the end of the arm. In

any case the arms have a very distinct annulated appearance, rings of white and brown skin alternating very regularly to the very tip of the arm. — Sometimes the tubercles on the arms are distinctly oblong. How Bell came to the statement that "the spines of the lower surface (of the arms) are set in a single row on either side of the median furrow" I do not understand. At the merest glance it is seen that there are two arm-spines, not one. Farther out on the arm the inner arm-spine becomes somewhat elongated, very distinctly club-shaped and distinctly thorny in the thickened end. The outer arm-spine remains short and thin and often has the appearance of a small side-branch on the larger, club-shaped spine; both are placed on the top of the somewhat prominent side plates; these latter are separated from each other by the well developed ventral plates. The tentacles are sheathed, more or less distinctly, till about the middle of the arm. The ventral surface is covered by a perfectly smooth skin. The "five prominent spines" which, according to Bell, "guard" the mouth, can be nothing but the mouth edges. There is a vertical series of about 10 broad triangular teeth and some small grains on the sides of the mouth edges.

The "Terra Nova" secured 7 specimens (E. of North Cape, 70 fms), ranging in size from 8 to 12 mm diameter of disk. A small specimen, taken off Three Kings Isl., in 60 fathoms, was given me by Captain Bollons.

That this beautiful Ophiurid is no *Astroscema* is evident enough and that it cannot be referred to the genus *Ophiocreas* is likewise clear — if we do not want to extend the limits of the latter genus beyond the usual conception, which would not be in any way desirable. It seems beyond doubt that this species is the nearest related to *Astroceras compar* Koehler from the Malay Archipelago, and if this latter is justly referred to the genus *Astroceras*, the present species must also be included in that genus. From the figure of the oral side of *A. pergamena*, the type of that genus, given in the "Challenger" Ophiuroidea Pl. XXXIV.<sup>1</sup> it might well appear that the genital slits are quite different from those of the present species, being represented there as long, narrow, horizontal slits, while here they are short, wide, and vertical, as characteristic of the *Trichasteridae*. It is, however, certain that the said figure is incorrect. In the diagnosis Lyman correctly states that the

genital slits are vertical, as also I find them in specimens which I have collected myself in the Japanese seas. — In any case, it seems to me that the present species must be referred to the genus *Astroceras*, if it is not made the type of a separate genus, which latter course I would not think desirable at the present state of our knowledge.

#### 7. *Astroschema* sp.

On a piece of a Gorgonid from off Three Kings Isl., 60 fms., collected by Captain BOLLONS, I found two small specimens, 1—1.5 mm diameter of disk, which, evidently, belong to a species of *Astroschema*. It is hardly possible to identify the species — very probably they belong to some undescribed species. In any case these young specimens are interesting as they prove that also a species of *Astroschema* proper occurs in the sea here off the North end of New Zealand. In the younger of the two specimens the 6 primary plates and the radial shields are still distinct, not yet obscured by the covering of the grains. In the larger specimen only the central plate is still discernible. The genital slits have already made their appearance, even in the smaller specimen.

#### 8. *Gorgonocephalus chilensis* (Phil.), var. *novæ-zelandiæ* n. var. Pl. IV. Fig. 1.

Cook Strait, 100 fms. 1 specimen, collected by Mr. HAZELWOOD, 1921.

I do not see any characters by which this specimen, which measures 50 mm diameter of disk, could be distinguished from *G. chilensis* (Phil.). Only the short stumps of the disk are sparser than appears to be the rule in *chilensis*, and for this reason I think it correct, at least for the present, to regard the New Zealand form as a separate variety of this species. If it should be ultimately shown, when more material is at hand, that the disk covering varies so as to be sometimes closer and more like what is usual in *chilensis*, I should not hesitate in simply uniting them. As the species is known to be distributed from South America to Kerguelen and Heard Island, it would not be very surprising if it turned out to occur also in the New Zealand seas.

The small conical tubercles of the dorsal side are rather numerous on the ribs, few and very sparse in the interspaces; similar tubercles also occur on two of the arms at their base, mainly on the sides. On the oral side a very few tubercles are found in the interbrachial spaces. The underside of the arms is covered by very fine granules, seen distinctly only when dried. When these grains are removed (by means of hypochlorite of sodium) irregular small plates are seen to fill the spaces between the lateral plates, which join in the ventral midline.

### 9. *Ophiomyxa brevirima* H. L. Clark.

Figs. 4-5.

- Ophiomyxa australis* Ltk. H. Farquhar. 1895. Notes on New Zealand Echinoderms. Trans. N. Z. Inst. XXVII. p. 199.  
 — — H. Farquhar. 1898. On the Echinoderm Fauna of N. Z. Proc. Linn. Soc. N. S. Wales. p. 309.  
 — — W. B. Benham. 1909. Scientific Results of the N. Z. Governm. Exped. 1907. Echinoderma. Rec. Canterb. Mus. 1.2. p. 19.  
 — *brevirima*. H. L. Clark. 1915. Catalogue Rec. Ophiurans; p. 169. Pl. 1.3-4.

Non: *Ophiomyxa australis*. Lütken. 1869. Add. ad hist. Ophiuridarum. III. p. 45.

- — *brevirima*. F. Jeffr. Bell. 1917. British Antarctic ("Terra Nova") Exp. 1910. Echinoderma. Zool. IV 1. p. 7. (= *Ophiocreas constrictum* Farquhar).

Masked Island, Carnley Harbour, Auckland Isl. 3/XII.1914 4 specimens.  
 Figure 8 Island, Carnley Harbour, Auckland Isl. 2/XII.1914. 12 specimens, found in the base of a *Macrocystis*, cast on shore.

Paterson Inlet, Stewart Isl., 5-15 fms. 17/XI.1914. 5 specimens.

Queen Charlotte Sound, 3-10 fms. 20/I.1915. 3 specimens.

Colville Channel, 35 fms. 21/XII.1914. 1 young specimen.

10 M. N.W. of Cape Maria v. Diemen; 50 fms. 5/I.1915. 2 young specimens.

Three Kings Isl., 65 fms. 5/I.1915. 1 young specimen.

The identification of the young specimens from the three latter localities is not beyond doubt; especially that from Three Kings Isl. recalls to some degree *Ophiomyxa australis*. It is, therefore,

not improbable that more than one species of *Ophiomyxa* will ultimately be found to occur in the New Zealand seas.

It is the merit of H. Lyman Clark to have pointed out that the *Ophiomyxa* of New Zealand seas is not identical with that of

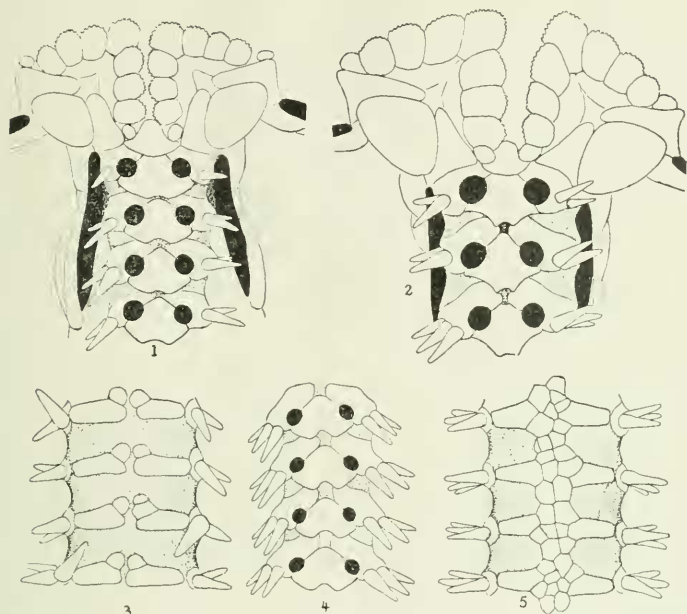


Fig. 4. *Ophiomyxa brevirima* (1, 3, 4) and *O. australis* (2, 5). All the figures  $\frac{6}{1}$ . — 1. Part of ventral side of *O. brevirima*; — 2. same part of *O. australis*. — 3. Part of dorsal side. — 4. part of ventral side of arm of *O. brevirima*. — 5. Part of dorsal side of arm of *O. australis*.

the Australian seas, *Ophiomyxa australis* Ltk., as was stated by Mr. Farquhar. However, the characters pointed out by H. L. Clark as distinguishing the New Zealand species from *O. australis* do not all hold good. The genital slits, as well as the radial shields, do not appear to me to offer any reliable differences. The number and arrangement of the arm spines: alternating 3 and four in *brevirima*, 5—6, not alternating in *australis*, is a much better and fairly constant character. But there are some other not less important differences. Thus the shape of the dorsal and ventral plates is rather different in the two species. (Cf. Fig. 4). (The thick

skin obscuring the plates must be removed in order to make the outline of these plates distinct; this may be done by applying hypochlorite of sodium to some part of the arm, the treatment being discontinued before the plates are becoming isolated). In

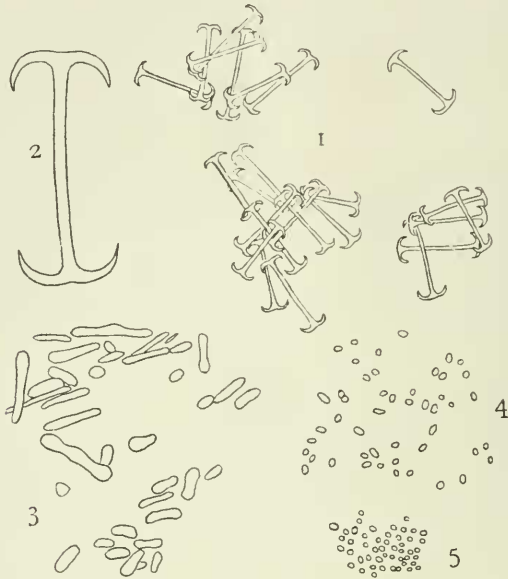


Fig. 5. 1. Spicules from an ovary of *Ophiomyxa australis*, in a natural group.  $130/\mu$ . — 2. One of these spicules more enlarged.  $265/\mu$ . — 3. Spicules from the bursal wall of *O. australis* in a natural group.  $130/\mu$ . — 4. Spicules from the bursal wall of *O. brevirima*, natural group.  $130/\mu$ . — 5. Spicules from the skin of white-ringed variety of *O. brevirima*.  $270/\mu$ .

both species there is on the dorsal side of each armjoint a pair of large plates, looking like a continuation of the side arm plates, which, however, they are not; these plates do not join in the dorsal midline, but are separated here in *O. australis* through a continuous mosaik of small polygonal plates (Fig. 4.5), in *O. brevirima* through only some few (2—3) such small plates, which do not form a continuous mosaik. (Fig. 4.3). Also the shape of the ventral plates is different, the outer edges being much more pointed in *australis* than in *brevirima* (Fig. 4.1—2).

There are, however, still other differences. In *O. australis* the

eggs are rather small, ca. 0,25 mm, and the ovarian membrane is studded with those remarkable double anchors characteristic of *Ophiomyxa* (Fig. 5.1-2); the bursal wall is full of small bone-shaped calcareous bodies (Fig. 5.3). In *O. brevirima* these latter bodies are much smaller (Fig. 5.4), the double anchors much fewer in number, and the eggs much larger, 0,5-6 mm. The latter fact indicates that probably a considerable biological difference exists between the two species. Nothing is known about the development of *O. australis*, but the relatively small size of the eggs lends support to the suggestion that it is not viviparous, whereas *O. brevirima* is viviparous. In one specimen from Lyttelton harbour I find one fairly large young one in each of two bursæ. Another specimen, from Cook Strait, collected by Mr. W. R. B. Oliver (as was also the specimen from Lyttelton) likewise contains young ones in its bursæ; but here conditions are quite different. All the bursæ are here completely filled up with embryos, most of them in nearly the same stage of development, with 2-3 armjoints developed, only very few being in a younger stage. They lie so closely packed that they are partly quite irregularly compressed. I have counted no less than 120 embryos in one bursa. They are of a bright orange colour, on account of the content of yolk in the eggs. — The difference between the two said specimens, one having the bursæ quite filled with embryos, the other having only one in each bursa, is so remarkable that the suggestion lies at hand that they may represent two different species, the more so as the two specimens are quite different in colour, one being of a uniform grayish-brown, the other (the one with the many embryos) greenish with white bands on the arms and irregular white spots on the disk. This white colour is due to closely packed heaps of exceedingly minute, lenticular calcareous grains (Fig. 5.5). (Such grains are also found in the skin of the not banded or spotted specimens, only much less numerous, scattered, not in dense heaps). I am, however, unable to find any other difference. Accordingly, it would appear that we have to do with only one species, and the difference in regard to the embryos contained in the bursæ may then perhaps be due to one of them having discharged its brood, with the exception only of a few of them, which have remained in the bursæ a little longer,

and perhaps therefore grown a little larger. This is, of course, nothing but a suggestion. Observations on a larger material, and especially on living specimens, will be needed to settle the question how the difference described is to be explained.

The discovery that *O. brevirma* is viviparous naturally led to the suggestion that it might then perhaps prove to be identical with the *Ophiomyxa vivipara* Studer of the Magellanic region. This it is, however, not. There is a conspicuous difference in the shape of the ventral plates (see fig. 6) as also in the dorsal plates; the two large lateral plates are not found in *O. vivipara*, the whole

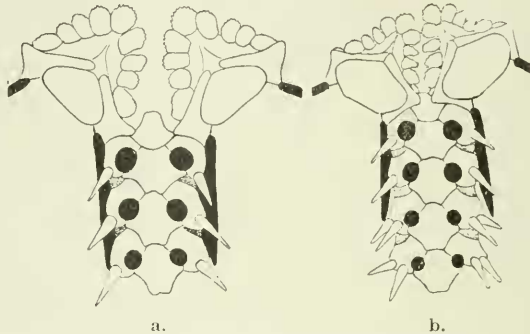


Fig. 6. Part of ventral side of *Ophiomyxa vivipara*:  
a. of a specimen from the Cape region, b. of a specimen from Patagonia. <sup>6/1</sup>.

dorsal side of the arm being occupied by one large, thin and delicate fenestrated plate. It should be pointed out that *O. brevirma* has separate sexes, as is also the case with *O. vivipara*.

I would still add that probably the specimens from the Cape region referred to *Ophiomyxa vivipara* do not really belong to that species, but represent a separate species, as is also suggested by H. L. Clark in his "Echinoderm Fauna of South Africa".<sup>1)</sup> I shall not, however, enter on a discussion of this question here.

#### 10. *Ophiacantha vilis* n. sp.

Figs. 7. a-d.

Some specimens from Cooks Strait, 200 fathoms (collected by Mr. Hazelwood, 1920) were sent me by Mr. W. R. B. Oliver. They are all in a rather poor state of preservation.

<sup>1)</sup> Annals of the S. African Museum. XIII. 1923; p. 313.



Disk covered with a uniform coat of small spines or stumps generally ending in four short, diverging points. The scales of the disk are generally discernible, though with some difficulty (on the figure they are rather too distinct and the coat of spines not

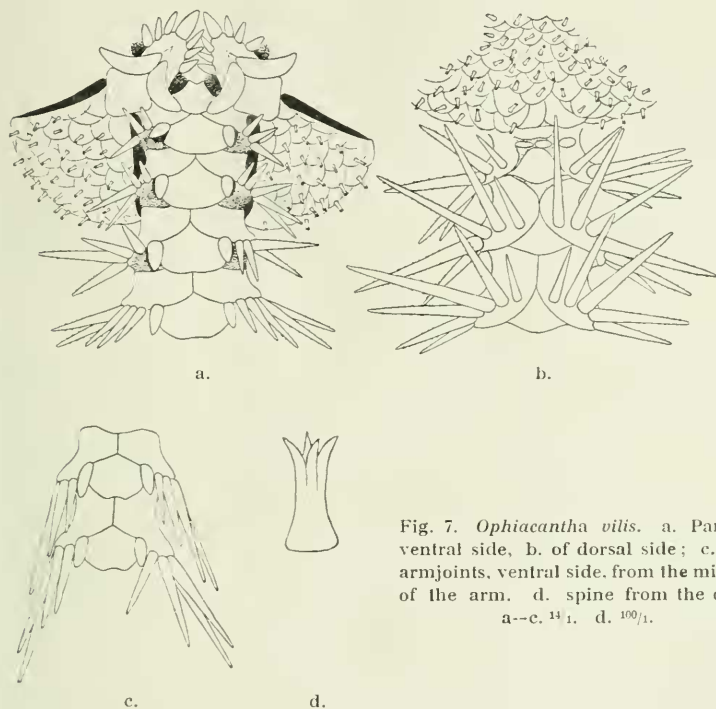


Fig. 7. *Ophiacantha vilis*. a. Part of ventral side, b. of dorsal side; c. two armjoints, ventral side, from the middle of the arm. d. spine from the disk. a--c.  $14\times$ , d.  $100\times$ .

dense enough). The radial shields not distinct, only just the outer end may be visible. On the underside of the disk the scaling is more distinct, the spine-covering less dense. — The oral papillæ are three to each side, the outer one generally scarcely widened; the infradental papilla is fairly large; rarely one may find in one of the mouth angles the outer papilla represented by two much narrower ones, there being thus four papillæ here. The mouth shields are about equally long and broad, with a somewhat produced outer lobe; the adoral shields crescent-shaped, meeting broadly within, but not produced outwards so as to separate the mouth shield from the first side armplate. The ventral plates are broader

than long; the two inner ones are in contact, the second one having the inner edge truncated; the third almost reaches the second, but from the fourth they are widely separated. The inner ones have a convex outer edge, from the fourth the outer edge has a reentering curve, which gradually becomes more marked farther out. In the outer part of the arm the ventral plates are about regularly heptagonal. There is a single, rather large, smooth tentacle scale. The dorsal plates are very small, triangular, with a slightly arched outer edge, widely separated throughout the whole length of the arm. The side armplates are rather prominent, carrying 7—8 long, slender, very finely serrate armspines; farther out there are only 6 spines. On the proximal joints the spines may almost join in the dorsal middle line.

None of the specimens exceed a size of 4 mm diameter of disk. The arms are broken, but apparently they are only ca. 4—5 times so long as the diameter of disk. The colour appears to be that usual in *Ophiacantha*'s, a light yellowish-brown.

This species, the first *Ophiacantha* recorded from the New Zealand seas, is very closely related to *Ophiacantha pentagona* Koehler, a species widely distributed over the Indo-Pacific Ocean. It differs from that species in the shape of the stumps covering the disk, these being provided with much longer thorns in *O. pentagona* (cf. Pl. IV. Fig. 29 of Koehler's Report on the "Investigator" Ophiuroidea and Pl. 93.5 of the Philippine Ophiurans);<sup>1)</sup> also the tentacle scale appears to be distinctly smaller in *O. pentagona*; the shape of the buccal shield is slightly different, and there are only 5—6 armspines in *O. pentagona*.

Also to another species it bears a very close resemblance — I rather think still closer than to *O. pentagona* —, viz. to *O. adiaphora* H. L. Clark, from the North Pacific, the main difference from that species being found in the shape of the mouth shield. A character which might look rather essential is the shortness of the genital slits in *O. adiaphora*, where they appear not to reach beyond the first armjoint, while in *O. vilis* they reach almost to the edge of the disc. I cannot, however, ascribe any greater signific-

<sup>1)</sup> R. Koehler. Ophiurans of the Philippine seas and adjacent waters. Bull. N. S. Nat. Mus. 100. 1922.

ance to this apparent difference. In some of the New Zealand specimens the genital slit appears to be no longer than in *O. adiaphora*, while in others it appears to reach to the edge of the disc. The bad preservation of the specimens in hand makes it impossible to make out exactly how the genital slits really are in this species — in some places they even have the appearance of being divided into two parts, as in *Ophioderma*.

I think it quite possible that both *O. adiaphora* and *O. vilis* will ultimately prove to be the same species as *O. pentagona* (also Clark points out the close resemblance of his species to *O. pentagona*). But for the present it seems to me more safe to regard the New Zealand form as a separate species, especially so long as *O. pentagona* or *O. adiaphora* have not been found in the Australian seas.

#### 11. *Ophiothrix aristulata* Lyman.

- Ophiothrix aristulata*. Th. Lyman. 1882. Challenger Ophiuroidea, p. 223, Pl. XXI. Figs. 9—12.
- — R. Koehler. 1904. "Siboga" Ophiuroidea. I. p. 151.
- — H. Lym. Clark. 1915. Catalogue Recent Oph. p. 269.
- — — 1916. Report on the Sea-Lilies, Starfishes, Brittle Stars and Sea-Urchins. . . . "Endeavour". Biol. Res. Fishing Experiments by the "Endeavour". IV.<sub>1</sub>, p. 89.
- sp. F Jeffr. Bell. 1917. Echinoderma. British Antarctic ("Terra Nova") Expedition 1910. Zoology IV.<sub>1</sub>, p. 6.
- *aristulata*. R. Koehler. 1922. Ophiurans of the Philippine seas and adjacent waters Bull. U. S. Nat. Mus. 100. Vol 5, p. 205. Pl. 35. 1—3. Pl. 97.<sub>1</sub>, a—f.
- — H. L. Clark. The Echinoderm Fauna of S. Africa. Ann. S. Afr. Museum. XIII. p. 336.

The two specimens of *Ophiothrix* sp. from off Cape Maria van Diemen, mentioned by Bell (Op. cit.), which I have had the opportunity of examining, undoubtedly belong to this characteristic species. They agree in all essential features with the description and figures given by Lyman. The keel on the dorsal midline of the arms is rather indistinct, more so in the larger specimen (diameter of disk 7 mm) than in the smaller one (6 mm). The only noteworthy difference from the type is that the spines on the

ventral side and near the edge on the dorsal side of the disk are short trifid stumps, not long, serrated spines as in the middle of the disk. Evidently this feature is not of sufficient value for separating these New Zealand specimens from the typical form, not even as a variety.

The species being widely distributed in the Indian and Australian seas, as far South as Tasmania, its occurrence in New Zealand seas (off North Cape and Cape Maria van Diemen) is not surprising at all.

From *Ophiothrix Oliveri* Benham, the other species found in New Zealand waters, it is very easily distinguished through its naked radial shields and the long spines covering the disk scales, *O. oliveri* having the disk with the radial shields completely covered with small, trifid stumps. Also the shape of the dorsal plates is quite different in the two species.

## 12. *Ophiothrix oliveri* Benham.

Fig. 8.

*Ophiothrix oliveri*. Benham. Stellerids and Echinids from the Kermadec Islands. Trans. N. Z. Inst. Vol. XLIII. 1910. p. 154.  
H. L. Clark. Catalogue Rec. Ophiurans. 1915. p. 276.

Off Little Barrier Isl., 30 fms; shells, 2 specimens.

Three Kings Isl., 65 fms.; hard bottom. 1 specimen.

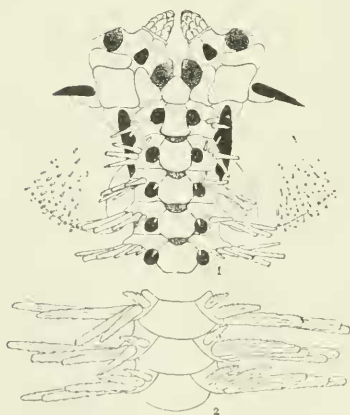


Fig. 8. *Ophiothrix oliveri* Benham. 1. Part of ventral side; 2. dorsal aspect of three armjoints, from the middle of the arm.  $\frac{7}{1}$ .

Judging from the description and figures of this species given by Benham it would seem that the specimens in hand could not be simply identified with the Kermadec-species; especially the shape of the ventral plates in Benham's Fig. 14 differs rather conspicuously from that of the New Zealand specimens, as shown in Fig. 8.1. The direct

comparison with one of the cotypes of *O. oliveri*, which I have received through the kindness of Mr. W. R. B. Oliver, shows, however, that the difference in the shape of the ventral plates is only apparent, due to the rather crude character of the said figure in Benham's paper. I find the ventral plates in the cotype, from the Kermadec Islands, to be quite like those of my New Zealand specimens, as represented in Fig. 8.1.

There are a few other points to which attention should be called, indicating apparent differences between the New Zealand specimens and the typical form from the Kermadecs. Benham states the dental papillæ to be arranged in four horizontal rows of 4 in each row, making thus 4 vertical rows. In the cotype in hand the papillæ form only three vertical rows; only at the upper (outer) edge there are four small papillæ. This discrepancy, evidently, is due to the fact that the type specimen was much larger, 14 mm diameter of disk, the cotype measuring only 7 mm. Otherwise Benham's figure does not correspond to the description, as it shows 7 and 5 papillæ in a horizontal row. The New Zealand specimens agree with the cotype in having the papillæ in three vertical columns; only in the largest specimen, 8 mm diameter of disk, the upper papillæ are fairly distinctly arranged in four columns. — The small oval plate, seen along the genital slits in Benham's figure, I do not find in any of the specimens in hand; on the other hand, Benham does not show the large genital plate bordering the outer extremity of the genital slits. The raised median prominence in the distal margin of the dorsal plates I do not find either in the cotype or in the New Zealand specimens, or, at most, only very indistinctly indicated. This can thus hardly be a constant feature. Upon the whole, I do not see any character by which it might be possible to distinguish the New Zealand specimens from those from the Kermadecs, not even as a variety.

The variety of this species mentioned by Benham (Op. cit. p. 156) does not appear to me to deserve this designation. Prof. Benham having kindly sent me one of the specimens I must say that on comparing it with the cotype and with the New Zealand specimens I do not see any reason for distinguishing it as a separate variety. The fact that the radial shields are more distinct

than in the type is due simply to its bad state of preservation, the spines normally covering the radial shields having dropped off.

### 13. *Ophiocormus notabilis* H. L. Clark.

*Ophiocormus notabilis*. H. L. Clark. 1915. Catalogue of Recent Ophiurans. p. 219. Pl. 3, 11-12.

Not having seen any specimens of this Ophiurid, known only through H. L. Clark's description of the unique specimen found by Mr. Farquhar under a stone near low water mark off Wellington, I can only offer a few critical remarks to the said description.

H. L. Clark includes this form among the Ophiacanthidæ, as an extreme development from an *Ophioconis*-like ancestor, though recognizing the uncertainty of its real relationships, stating that "it is quite possible that its true position is in the Ophiodermatidæ". — Judging from the figures given by Clark one cannot help thinking the latter suggestion by far the more probable; in fact, were it not for the grains covering the base of the arms. I would suggest it to be a young *Pectinura*. But, as justly said by Clark, "much more abundant material is necessary before the matter can be satisfactorily determined." I would only point out this case as exemplifying in quite a special degree the insufficiency of photographic figures. I defy anybody to find in the figures, given by Clark, the details of the armplates or the mouth structure. We gather from these figures that it is an Ophiurid with very short, robust arms, with short, appressed armspines, the disk being covered with grains. But this is not satisfactory in an up to date work on Ophiurids.

### 14. *Ophiocoma Bollonsi* Farquhar.

Fig. 9.

*Ophiocoma Bollonsi*. Farquhar 1908. Description of a new Ophiurid. Trans. N. Z. Inst. XL. p. 108.

— — H. L. Clark. 1915. Catalogue Rec. Ophiurans. p. 293.

— — — 1921. The Echinoderm Fauna of Torres Strait: its composition and its origin. Publ. Carnegie Inst. 214 p. 132.

Of this species, hitherto known only from the single specimen on which Farquhar based his description, I have been fortunate enough to find three specimens in the following localities:

Wellington Harbour, 5—10 fms; hard bottom.

2 Miles E. of North Cape, 55 fms: hard bottom.

Three Kings Isl., 65 fms; hard bottom.

Further I have received through Mr. W. R. B. Oliver a few specimens from the Cooks Strait, 120 fms., collected by Mr. Hazelwood.

To the very careful description of this species given by Farquhar I have but little to add. On the other hand, it may be of importance to give a pair of figures of the species, Farquhar not having published any.

The tooth-papillæ, which are rather exceptionally numerous for an *Ophiocoma*, are arranged above in 6 irregular transverse series; inwards in the mouth they gradually decrease in numbers, only the lateral series on each side continuing until they meet the teeth, which are squarish, provided with an enamel cap, as usually in *Ophicoma*. There are 7 tooth papillæ in

the vertical row of the outer series, and below the e papillæ (or above them, if we place the animal in its natural position) 2—4 teeth. The mouth is thus very deep. The outer series of the tooth papillæ are longer than the inner ones, the chewing surface of each jaw thus being concave. — The side mouth shields may be excluded from the adoral edge of the genital slit (Fig. 9.1). Regarding the shape of the ventral and dorsal plates I may content myself with referring to the figures. The spines may be in the number of 8

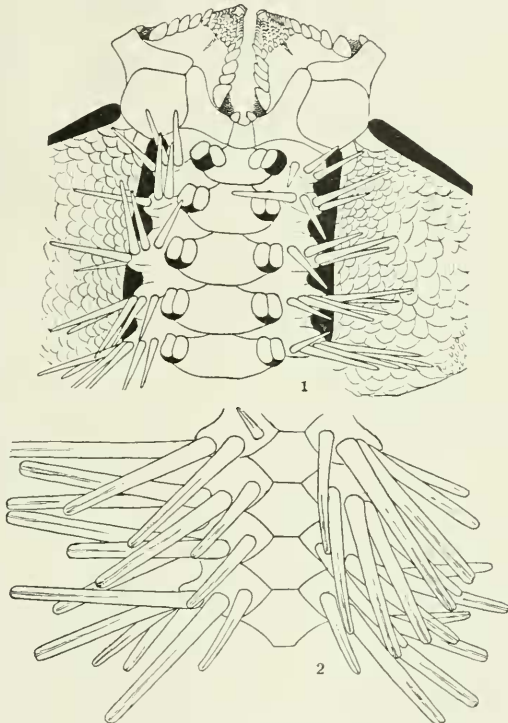


Fig. 9. *Ophiocoma bollonsi* Farquhar. — 1. Part of oral side; — 2. armjoints, from the dorsal side.  $\frac{6}{1}$ .

in the inner part of the arm in the larger specimens, increasing in length from the ventral side upwards, the uppermost one being again smaller, sometimes quite small. They are very slender, smooth (— I do not find them "granular", as Farquhar states them to be —), flattened dorsoventrally and with a slight furrow along the upper side. They are not widened at the point.

The tubefeet are strongly papillated, as usual in *Ophiocoma*. The very small size of the eggs indicates that the larva must be a typical *Ophiopluteus*.

Some of the armspines are clubshaped through the skin being much thickened in the outer part. That this is due to an infesting parasitic organism may well be concluded from the fact that the occurrence of such swollen spines is without any order whatever. What sort of organism I have been unable to ascertain. In sections of such spines the skin is seen to have a peculiar radiate structure; but no trace could be found of a foreign organism to the action of which this peculiar structure might be due.

As pointed out by Clark (Op. cit.) this species is most nearly related to *Ophiocoma canaliculata* Ltk., with which it has in common a. o. the peculiar character of the canaliculate spines.

### 15. *Ophiopteris antipodum* E. A. Smith.

Fig. 10

- Ophiopteris antipodum*. E. A. Smith. 1877. Description of a new form of Ophiuridæ from New Zealand. Ann. Mag. Nat. Hist. 4. Ser. XIX. p. 305. Pl. XV.
- — Th. Lyman 1882. "Challenger" Ophiuroidea; p. 168, 176.
- — H. Farquhar. 1897. Contribution to the Hist. N. Z. Echinoderms. Journ. Linn. Soc. Zool. XXVI. p. 192.
- — — 1898. Echinoderm Fauna of New Zealand. Proc. Linn. Soc. N. S. Wales, p. 308.
- — H. L. Clark. 1915. Catalogue Recent Ophiurans p. 294.

While no specimens of this species were collected by myself during the investigations in New Zealand Seas, I had the pleasure of receiving two fine, dried specimens from Mr. W. R. B. Oliver, who had found them under stones at low water mark at Rangitoto Isl. in Auckland Harbour. The species having hitherto



been recorded only from Cook's Strait (Wellington, Nelson), this new locality is of considerable interest, showing that the species must be more widely distributed along the New Zealand coasts, probably all round the North Island.

The very careful description given by E. A. Smith does not leave much to be desired; only his figure of the mouth-structure is insufficient, being drawn in too small a scale for showing the shape of the mouthparts exactly and sufficiently detailed. I give, therefore, a figure here to illustrate these parts (Fig. 10).

As pointed out by E. A. Smith, the mouth structure has a considerable resemblance to that of *Ophiothrix*, differing from it only in the presence of mouth-papillæ. These, however, are quite different from those of other Ophiocomids in lying along the edge of the mouth frame, covering one



Fig. 10. Part of oral side of *Ophiopterus antipodum*. E. A. Sm.  $\frac{6}{1}$ .

another, not placed side by side along the mouth frame and at a right angle therewith as usually in Ophiocomids; in fact, there is no distinct limit between the mouth papillæ and the tooth papillæ, the former passing quite gradually into the outer series of the tooth papillæ. It is also important to notice that the teeth are not capped with enamel as is the case in most Ophiocomids. Further the peculiar shape of the adoral shields recalls *Ophiothrix* much more than the Ophiocomids. In fact, these characters are important enough to make it doubtful, whether this genus really belongs the Ophiocomidæ. On the other hand, the characters of the arms and disk decidedly recall the Ophiocomidæ. — In short, this genus would appear to be intermediate between the Ophiothrichidæ and the Ophiocomidæ. A study of its anatomy and, especially, its larval development would probably decide the question of its true relationship, the larvæ of *Ophiocoma* and *Ophiothrix* being both very characteristic.

16. *Ophiactis resiliens* Lyman.

Figs. 11.1-4.

- Ophiactis resiliens*. Lyman. 1882. Challenger Ophiuroidea, p. 115. Pl. XX. Figs. 7-9.
- *nomentis*. Farquhar. 1907. Notes on New Zealand Echinoderms, with descript. of a new species. Trans. N. Z. Inst. XXXIX. p. 125.
- — Benham. 1909. Scientific Results N. Z. G. Trawling Exped. Rec. Canterbury Mus. I. Nr. 2. p. 23.
- *resiliens*. H. L. Clark. 1909. Scientif. Results of the Trawling Expedition of H. M. C. S. "Thetis". Mem. Austral. Mus. IV. p. 539.
- — — 1915. Catalogue Recent Ophiurans. p. 265.
- *nomentis* — — p. 264.
- *resiliens* — Pl. 11. figs. 1-2.
- — — 1916. Report on the Sea-Lilies, Starfishes, Brittle Stars etc. Biol. Res. Fishing Exper. F. I. S. "Endeavour". IV. 1. p. 87.
- — — 1918. Brittle-Stars, new and old Bull. M. C. Zool. LXII. p. 312.
- *nomentis* — 1918. Ibid. p. 312.

Off White Island, (37° 40' S. 177° 1' E.), 55 fms; sandy mud. 19/XII.14. 1 specimen.

Slipper Island, under stones at low water. 20/XII.14. 2 specimens

Colville Channel, 35 fms; sandy mud. 21/XII.14. 1 specimen.

Little Barrier Isl, 30 fms; shells. 29/XII.14. 1 specimen.

Moku Hinau Isl., Hauraki Gulf; 5 fms; gravel. 30/XII.14. 1 specimen.

10 M. N.W. of Cape Maria v. Diemen; 50 fms; hard bottom. 5/I.15. 4 specimens.

Off New Plymouth; 8 fms; hard bottom. 12/I.15. 3 specimens.

Cook Strait, 120 fms. 13/VIII.1920. (Coll. by Mr. Hazelwood; received from Mr. W. R. B. Oliver).

In his paper "Brittle-Stars, old and new" (p. 312) H. L. Clark states regarding *Ophiactis nomentis* Farquhar that it is very near *O. resiliens* Lyman "though apparently larger, but if the differences in the oral shields and adoral plates prove to be constant, the two forms may well be kept apart". A very careful comparison of the two forms has led me to the result that they are decidedly identical, and the name *Ophiactis nomentis* thus becomes a synonym of *O. resiliens*.

The differences between the Australian and the New Zealand forms pointed out by H. L. Clark (Op. cit. p. 301) are these: in *O. resiliens* the oral shields are much wider than long; adoral plates with no distally projecting angle separating oral shields from side arm-plates; in *O. nomentis* the oral shields are about as long as wide; adoral plates with a distally projecting angle separating oral shields from side arm-plates

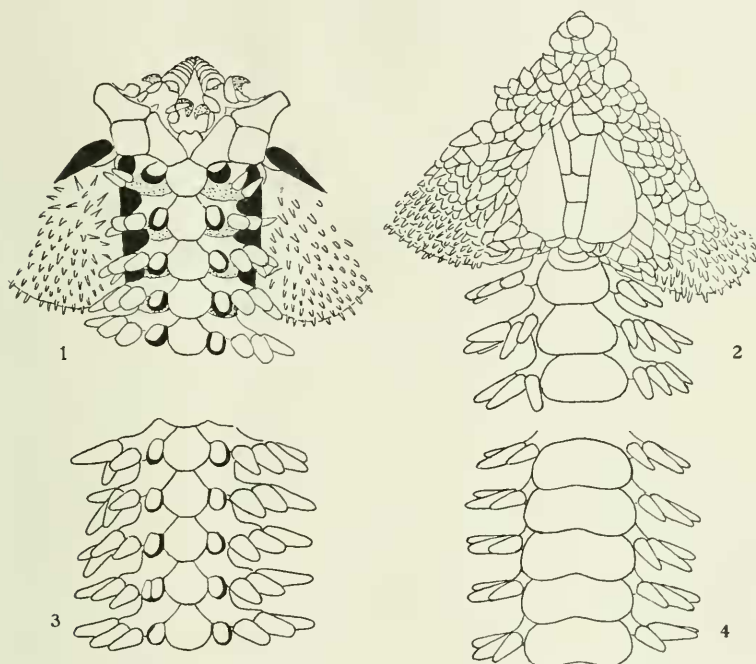


Fig. 11. *Ophiactis resiliens* Lyman. — 1. Part of oral side; 2. of dorsal side; 3. arm-joints from middle of arm, oral side; 4. same, dorsal side.  $\frac{10}{1}$ .

shields from side arm-plates. Regarding the latter character, the distally projecting angle of the adoral shields, it is seen from the figure given here, drawn from a specimen from Slipper Island, that it may be wanting just as well in the New Zealand as in the Australian form; of two specimens of the Australian form sent me by H. L. Clark one has the distally projecting angle of the adoral shields very distinctly developed. This character thus is decidedly of no value as a distinguishing feature. The difference in the shape of the oral shields thus remaining the only character to distinguish the two forms is decidedly too insignificant and inconstant to

serve as base for keeping the two forms as separate species. The only thing which makes me hesitate a little in declaring *O. nomentis* identical with *O. resiliens* is the fact that Farquhar in his description of *O. nomentis* says: "one rounded leaflike mouth-papilla on each side of the base of the mouth-angle". As a matter of fact, my specimens, which otherwise agree very well with Farquhar's description, have two mouth-papillæ, as has *O. resiliens*. In the rather poor photographic figure given by H. L. Clark (Cat. Rec. Oph. Pl. 11.2) of a cotype of *O. nomentis* the mouth-papillæ are not distinctly discernible; but since Clark in his key to the species of *Ophiactis* (Brittle-Stars, old and new, p. 301) places *O. nomentis* in the group with 2 mouth-papillæ, the conclusion seems inevitable that Farquhar's statement is a mistake, and that the type of *O. nomentis* really had 2 mouth-papillæ.<sup>1)</sup> — It thus seems to me an unavoidable conclusion that *O. nomentis* is identical with the Australian species, *O. resiliens* Lym.

It may be pointed out that the concave outer edge of the dorsal plates in Fig. 11.4 is no constant feature, and cannot be used as a feature to distinguish the New Zealand from the Australian form.

The breaking up of the dorsal plates in several small irregular plates not rarely occurring in Australian specimens I have not observed in any of my New Zealand specimens; but Farquhar has observed it in his specimens.

The eggs are very small and numerous, which fact indicates almost certainly that this species has a typical *Ophiopluteus*-larva.

### 17. *Ophiactis hirta* Lyman.

Figs. 12, a-c.

*Ophiactis hirta*. Th. Lyman. 1882. Challenger Ophiuroidea, p. 118. Pl. XX, Figs. 4-6.

— — H. L. Clark. 1915. Catalogue Recent Ophiurans. p. 266.

— — — 1918. Brittle-Stars, new and old. Bull. Mus. C. Zool. Vol. LXII. p. 310.

<sup>1)</sup> In one of the specimens from Cook Strait, received through Mr. W. R. B. Oliver, I find in some of the mouthangles only one outer mouth papilla, in others two. This specimen is, upon the whole, somewhat abnormal. Another of these specimens has only 4 arms.

Among a number of *Ophiactis profundus* from Cook Strait, 120 fms (collected 13/VIII.1920 by Mr. Hazelwood), sent me by Mr. W. R. B. Oliver, I found one small specimen of an *Ophiactis*, which I do not hesitate in referring to *Ophiactis hirta* Lyman, in spite of its differing from that species in a few minor characters.

This specimen is a small one, measuring only 2,5 mm in diameter of the disk. It has only 6 arms, while the type specimen has 7 arms. That this could be a valid specific difference hardly anybody, who is familiar with the characters of Ophiurans, would

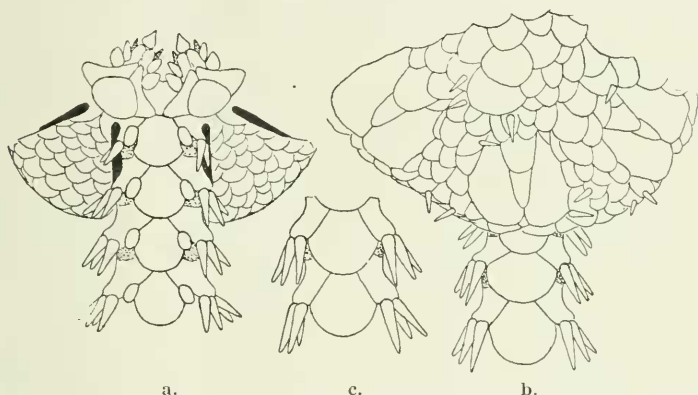


Fig. 12. *Ophiactis hirta* Lyman. — a. Part of oral side, b. of dorsal side; c. two arm-joints from middle of arm, dorsal side. <sup>20</sup>/<sub>1</sub>.

venture to maintain (— quite differently if we have to do with forms normally having 5 arms; comp. sub. *O. profundus*). The only other noteworthy differences to be observed between this specimen and the type, as figured by Lyman, are in the shape of the dorsal plates, which are more elongate in the New Zealand specimen than in the type, and in the oral papillae being slightly broader in the former than in the type. — I do not think that these small differences would justify us in distinguishing the New Zealand form even as a variety of the typical *O. hirta*. — The figures given here will serve to make clear the small differences from the type, and also to facilitate distinguishing this species from the other 6-armed *Ophiactis* occurring in New Zealand seas.

It should be emphasized that in the specimen in hand all the arms are equally developed, which may indicate that this species does not propagate through autotomy.

The species *Ophiactis hirta* being until now known with certainty only from off the coast of N. S. Wales through the single specimen collected by the "Challenger", it is very satisfactory that it has now been demonstrated to occur also in the Cook Strait. The statement of its occurrence in the Atlantic (Koehler. Echinodermes. Res. Campagnes Scientif. Monaco. Fasc. XXXIV. 1909. p. 171) probably refers to a specimen of *Ophiactis nidarosiensis* Mrtsn. (Comp. Th. Mortensen. Notes on some Scandinav. Echinoderms. Vid. Medd. Dansk Naturh. Foren. Bd. 72. 1920. p. 62). That this latter species is closely related to *O. hirta* seems beyond doubt; there is, however, a very marked difference in the shape of the mouth shields, and also the shape of the ventral plates is somewhat different. These characters, added to the fact that *O. nidarosiensis* is selfdividing, while *O. hirta*, according to the scanty evidence at hand, is not so, and to the fact of one being known with certainty only from the Scandinavian seas, the other only from the Australian-New Zealand seas, necessitate, at least for the present, that we regard these two forms as separate species.

18. *Ophiactis profundus* Ltk. & Mrtsn., var. *Novae-Zelandiae* n. var.

Figs. 13.1-4.

- Ophiactis profundus*. Lütken & Mortensen. 1899. "Albatross" Ophiuroidea. Mem. Mus. C. Zool. XXXIII. p. 140. Pl. VI. figs. 4-6.
- — H. L. Clark. 1915. Catalogue Recent Ophiurans. p. 264.
- — R. Koehler. 1922. Ophiurans of the Philippine seas and adjacent Waters. Bull. U. S. Nat. Mus. 100. p. 192. Pl. 63. fig. 8.

Hen & Chicken Isl., 50 fms 30 XII.1914. 1 specimen.

2 miles E. of North Cape. 55 fms. 2/1.1915. 2 specimens.

Cook Str. 120 fms. 13/VIII.1920. Several specimens. (Collected by Mr. Hazelwood).

These specimens are undoubtedly closely related to *Ophiactis profundus* Ltk. & Mrtsn. There are, however, some slight differences which make me hesitate in simply identifying them with that species.

The size appears to be, upon the whole, smaller than in the type, which has a diameter of disk of 6 mm. The New Zealand specimens, which are most of them in various stages of reproduction after division through autotomy, do not exceed a size of ca. 4 mm diameter of disk. Three of the specimens which have, apparently, finished dividing, since they have all 6 arms equally developed, and which would thus appear to have reached full size, measure only 3—4 mm diameter of disk. The mouth shields are generally broader than in the type; they are, however, subject to some variation. The difference in the shape of the infradental papilla, which is represented here as trifid, while in the type it is simply triangular, pointed, is of no value as a distinguishing feature, being altogether too inconstant; even in one and the same specimen we may find both shapes represented. For the rest it is hard to point out any noteworthy differences between the typical form and the New Zealand specimens, excepting the fact that the latter have 4 armspines, while the typical form has only three.

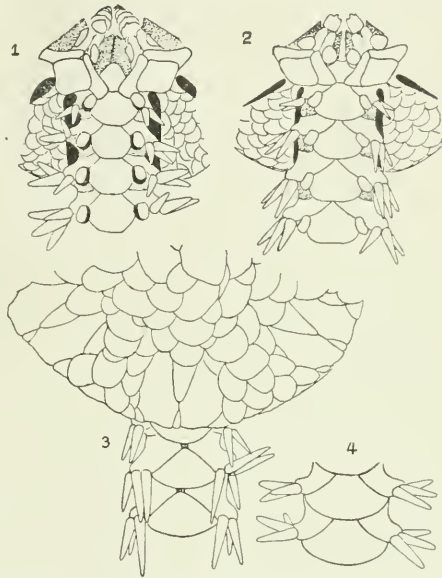


Fig. 13. *Ophiactis profundus*, var. *Nova-Zealandiae*. 1—2. Part of oral side of two different specimens; 3. part of dorsal side; 4. two armjoints, from middle of arm; dorsal side.  $\frac{15}{1}$ . The two figures 1 and 4 are from an aberrant specimen, from off the North Cape (cf. p. 131).

The characters here pointed out, viz. the smaller size, the different shape of the mouth shield and the different number of armspines, would seem to necessitate distinguishing the New Zealand specimens as a separate variety, the more so as the typical form was found in the Gulf of Panama and at Galapagos, in depths of 550—900 fms.

The weight to be attached to the wide separation of the localities is, however, considerably lessened through the fact that Koeh-

ler recently has recorded *O. profundus* from the vicinity of the Philippines. If Koehler is right in uniting the Japanese form *Ophiactis pteropoma* H. L. Clark with *O. profundus*, — as seems very probable — this would indicate that the species is probably distributed all over the Pacific, and the occurrence of a variety of it in New Zealand's seas would thus be very well in accordance with zoogeographical facts.

In his paper "Brittle-Stars, new and old" (Bull. Mus. C. Zool. LXII. 1918. p. 301) H. L. Clark has maintained that the species *Ophiactis plana* Lyman, *flexuosa* Lyman, *perplexa* Koehler, *profundus* Ltk. & Mrtsn. and *brachygenys* H. L. Clark are really all one and the same species, which is thus distributed all over the Atlantic and Indo-Pacific Oceans and has a bathymetrical range of 26—1048 fms. I cannot agree with Clark in this view. It is beyond doubt that they are all closely related, as every writer on these forms has well recognized. But the unusually great horizontal and bathymetrical distribution, which a species comprising all these forms would have, must make us look very carefully into the matter, before we accept their identity. One of the objections raised by Lütken & myself (Op. cit. p. 141) against the identity of *O. profundus* with *O. flexuosa*, at least, is still as valid as ever, viz. that *O. flexuosa* has only five arms, while *O. profundus* has constantly six arms; "there is no sufficient evidence that in any species the young has six arms, the adult only five" — and Clark has given no new evidence whatever as to this point. Concerning *O. plana* Lyman, from the Atlantic, the figures given by Clark in his "Catalogue of Recent Ophiurans" would seem to show that the ventral plates of this species are different in shape from those of the New Zealand form; for the rest these figures are not sufficiently distinct for allowing a detailed comparison. The fact that this species has 6 arms, otherwise, does not, a priori, make it improbable that it might be identical with *O. profundus*, but the available material does not seem to me to justify declaring them to be identical. As for *O. brachygenys* this form has five arms and is thus certainly not identical with *O. plana* or *O. profundus*, and the same holds good with regard to *O. perplexa*, which is otherwise distinguished by the spines occurring on the edge of the disk.

Thus, while agreeing that *O. plana* and *profundus* may possibly



prove to be identical I must maintain that sufficient proof of their identity has not yet been given, and for the present the only safe course is to keep them separate. Also the New Zealand form ought to be kept separate for the present, the differences pointed out above pointing more in the direction of its being a separate species than of its being simply identical with *O. profundi*.

One of the two specimens from off North Cape differs in the dorsal plates being in contact in the larger part of the arms, thus having a truncated inner angle, and also in the ventral plates being more broadly in contact than is otherwise the case, and, upon the whole, somewhat different in shape from those of the other specimens (Fig. 13.1 and 4). I do not think, however, that this can be regarded as more than an individual variation, especially since the said features are more conspicuous on one arm than on the others. But attention must be called to this form, which may possibly ultimately turn out to be another, distinct species. The two specimens from off North Cape have a few narrow, dark bands on the arms.

*"Ophiactis nigrescens"* Hutton.

Through the kindness of Mr. W. R. B. Oliver I have received a specimen of an Ophiurid from the Dominion Museum, Wellington, which is, according to a handwritten label by Mr. Farquhar, the type specimen of Hutton's "*Ophiocoma nigrescens*". Since Hutton did not describe any "*Ophiocoma nigrescens*", but only an "*Ophiactis nigrescens*", it would seem probable that this is the type specimen of the latter, to the description of which it corresponds fairly well. It is a very poor specimen of *Ophiocoma schoenleini* M. & Tr. — That it is not from the New Zealand seas is evident; most probably the specimens have come from Fiji, as had also the "*Ophiothrix coerulea*" of Hutton.

Herewith the "*Ophiactis nigrescens*", which has for so long a time puzzled the echinologists, may well disappear both from the list of Ophiurids and from the New Zealand fauna.

19. *Amphiura magellanica* Ljungman.

Figs. 14.1-3: 15.a.

- Amphiura magellanica*. Ljungman. 1866. Ophiuroidea viventia huc usque cognita. Öfvers. kgl. Vet. Ak. förh. p. 320.
- — (?) Th. Lyman. 1875. Zool. Res. Hassler Exped. II. Ophiuridæ and Astrophytidæ. III. Cat Mus Comp. Zool. VIII. p. 19
- — — 1882. "Challenger" Ophiuroidea, p. 143.
- — H. Ludwig. 1899. Hamburger Magalh. Sammelreise. Ophiuroidea. p. 10.
- — — 1905. Asterien u. Oph. d. schwed. Exped. Z. w. Zool. Bd. 82 p. 75.
- — R. Koehler. 1909. Asteroidea, Ophiuroidea & Echinoidea. Scottish National Ant. arct. Exp. Vol. V. Part. XIII. p. 271. Pl. XI. fig 104.
- — — 1914. Ophiurans of the U. S. Nat. Museum. Bull. U. S. Nat. Mus. 84. p. 65.
- — H. Lym. Clark. 1915. Catalogue Rec. Ophiurans. p 228.
- — Th. Mortensen. 1920. On hermaphroditism in viviparous Ophiurids. Acta Zoologica. I. p. 12.

Masked Island, Carnley Harbour. Auckland Isl. 3/XII.1914. Several specimens, on the rocks, among calcareous algæ (*Melobesia antarctica*).

Figure 8 Isl., Carnley Harbour, Auckland Isl. 2/XII.14. 4 specimens, under stones, at low water.

Port Ross, Auckland Isl., 10 fms. Sand. 25 XI.14. 1 specimen

Carnley Harbour, Auckland Isl., ca. 45 fms; sandy mud. 6/XII.1914. 1 specimen.

Perseverance Harbour, Campbell Isl. Ca. 20 fms, sandy mud. 10/XII.1914. 3 specimens.

Wellington Harbour, 5—10 fms, hard bottom. 16/II.1915. 2 specimens.

Queen Charlotte Sound, 3—10 fms, hard bottom. 20/I.1915. 2 specimens.

The finding of this interesting viviparous and hermaphroditic Ophiurid in New Zealand seas is rather surprising; not from a zoogeographical point of view — it is one of the forms which might be expected to have got a circumantarctic distribution through being carried by floating algæ —, but as it occurs in a place like

Wellington Harbour, we may well wonder that it has been overlooked hitherto. It is also surprising that it was not found by the Expedition to the sub-antarctic Islands of New Zealand, as it is fairly common at least in Carnley Harbour, occurring there on the rocky shores among the beautiful *Melobesia antarctica* which covers the vertical rock wall to a great extent; also under stones at low water mark it may be found.

Although mentioned fairly often in literature, the only figure of it ever published is that given by Koehler in his Report on

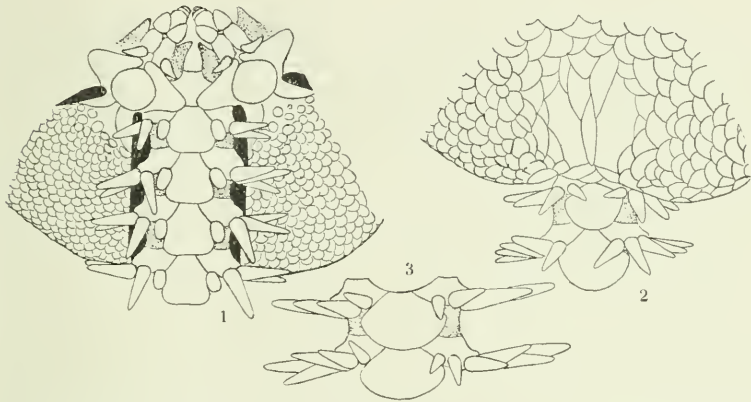


Fig. 14. *Amphiura magellanica* Ljungm. — 1. Part of oral side; — 2. of dorsal side; — 3. two armjoints from middle of arm, dorsal side. <sup>12</sup>/<sub>1</sub>.

the "Scotia" Echinoderms. It is therefore evidently not superfluous to give some figures here to illustrate the characters of this species. Also for comparison with the following species such figures are rather needed.

The largest specimens measure 6 mm diameter of disk, with an armlength of ca. 25 mm. Although fairly robust looking, it is exceedingly brittle, which may be due to the narrowness of the side armplates, leaving a rather large membranous space between each two successive plates. The radial shields are scarcely  $\frac{1}{3}$  of the disk radius. The primary plates hardly to be discerned in the larger specimens, while in the younger ones they are quite distinct. The disk generally swollen and bulging out between the arms. The tubefeet are somewhat papillose. In larger specimens there may be

7 spines on the basal armjoints; in the middle of the arm there are only 5 spines. The long, downwards directed ventral spines (Fig. 15.a), may perhaps have relation to the biology of the species: mainly living among algæ, not burrowing in sand or mud, as is otherwise the rule among Amphiurids.

*Amph. magellanica* was hitherto known to occur only in the Magellan region and at the Gough Island in the S. Atlantic. It is then of considerable zoogeographical interest to have proved it to occur also in the New Zealand region. The greatest depth at which

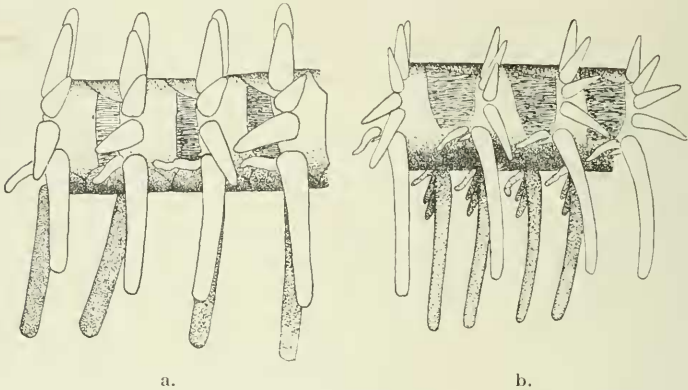


Fig. 15. Four armjoints from middle of arm, in side view, showing the elongated downward pointing lower spine. — a. *Amphiura magellanica*; b. *Amph. spinipes*. <sup>20</sup>/<sub>1</sub>.

it has been found is 75 fms (Gough Isl.). It appears to be mainly littoral.

After this had been written I received from Prof. Benham a specimen of this species dredged in Otago Harbour, 2 fms, and also one from Foveaux Strait. This proves, as might be concluded from its occurrence at the Cook Strait coast, that this species occurs along the coasts of the South Island of New Zealand. Whether it extends farther North than the Cook Strait remains to be seen.

#### 20. *Amphiura spinipes* n. sp.

Figs. 15.b: 16.a-c.

Little Barrier Isl., 30 fms, shells. 29/XII.14. 7 specimens.

Colville Channel, 35 fms; sandy mud. 21/XII.14. 8 specimens.

10 M. N.W. of Cape Maria van Diemen, 50 fms; hard bottom. 5/I.15.

Several specimens.

Three Kings Isl. 65 fms; hard bottom. 5/I.15. 5 specimens.

As appears from a comparison of the figures of this species with those of *A. magellanica*, it is really difficult to indicate reliable distinguishing features in the characters of the plates or spines. The oral shields have the same rounded shape in both forms; the ventral plates are more rounded at the outer edge in *spinipes*, more straight or even slightly concave in *magellanica* — but, although it may appear distinct enough in the figures, the difference is really very slight. The single tentacle scale quite alike in both

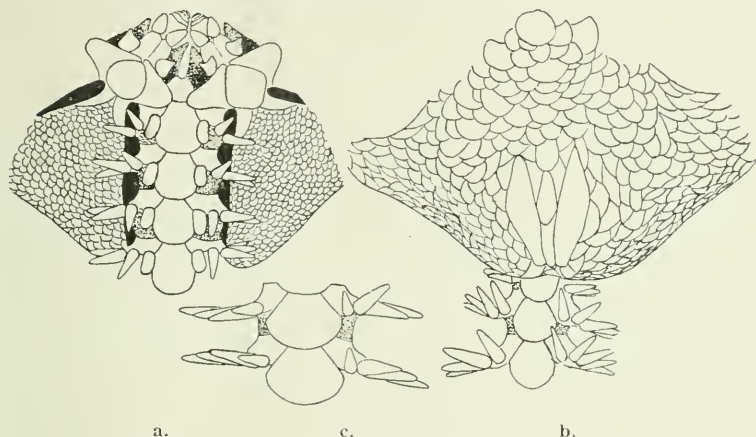


Fig. 16. *Amphiura spinipes* Mrtsn. — a. Part of oral side; b. of dorsal side; c. two armjoints from middle of arm, dorsal side.  $1\frac{1}{2}$ .

species. The dorsal plates in the interior part of the arm are somewhat narrower and more elongated in *spinipes* than in *magellanica*; those further out on the arm very nearly of the same shape in both species. The radial shields are narrower and more elongated than in *magellanica*, ca.  $\frac{1}{2}$  the disk radius, and the scales covering the disk on both sides are distinctly finer in *spinipes* than in *magellanica*. The arm spines are as in *magellanica*, 6 (more rarely 7) at the arm base, 5 farther out, and the ventral is very much elongated, somewhat curved, and directed straight downwards. The tube feet are not papillose.

Upon the whole, these two forms agree so closely that one might be more inclined to think the form, here distinguished as *Amph. spinipes*, merely to represent a more slender variety of *magellanica*. That it is, however, really a distinct species is proved

beyond any doubt by the fact that it is not viviparous and not hermaphroditic, as is *magellanica*. Also the eggs are distinctly smaller, only ca. 0,1 mm, those of *magellanica* ca. 0,2 mm, and probably it has then typical pelagic larvæ.

The species is, upon the whole, smaller and more delicate than *magellanica*; the largest specimen measures 5 mm diameter of disk; the arms are ca. 4—5 times the length of the diameter of disk. The long ventral armspines give the arms a very peculiar appearance, looking more like feet than like spines, and the suggestion lies at hand that they do really act as such (the species-name *spinipes* is meant to refer to this); they are gradually increasing in length from the base of the arm to the 8th—10th joint, remaining very long on some 20—25 joints, and then again gradually diminishing in length towards the point of the arm. It can hardly be doubted that this Amphiurid lives among shells a. o. hard objects on the bottom, not burying itself in the sand or mud, as do most other Amphiurids. Its long spines would, evidently, be very unfit for digging, but very useful for crawling among hard objects, in the same way as does *Amph. magellanica*, the armspines of which are exactly similar, only somewhat more robust.

Three specimens from North Channel, Kawaii, Hauraki Gulf, 10 fms (29/XII.14) I must hesitate in simply referring to this species. They are, in fact, more like *A. magellanica*, but not being viviparous nor hermaphroditic they cannot belong to that species. They are somewhat more robust than *A. spinipes*, and the ventral spines not so long as they generally are in that species. Also the eggs are somewhat larger. — I shall prefer to leave undecided at present, whether they should be regarded as a variety of *A. spinipes* or as representing, perhaps, a separate species. But it may be useful to call attention to the possible existence in New Zealand seas of still another species of the group of *Amphiura*'s with elongate ventral spines.

## 21. *Amphiura præfecta* Koehler.

Figs. 17.a—c.

*Amphiura præfecta*. R. Koehler. 1907. Revision de la collection des Ophiures du Muséum d'hist. Nat. Paris. Bull. sci. Fr. & Belgique. XLI. p. 302.

— — H. L. Clark. 1915. Catalogue Rec. Ophiurans; p. 235.

Masked Island, Carnley Harbour; Auckland Isl. Among *Melobesia antarctica* on rock wall. 3/XII.14. 10 specimens.

Perseverance Harbour, Campbell Isl., ca. 20 fms. Sandy mud. 10/XII.14. 3 specimens.

Only a few remarks need be added to the careful description given by Koehler, the figures otherwise supplying the necessary information.

The largest specimen measures 4 mm diameter of disk; the arms are ca. 4 times the diameter of the disk. The outer oral papilla is very broad, not pointed, but may be serrated along its free

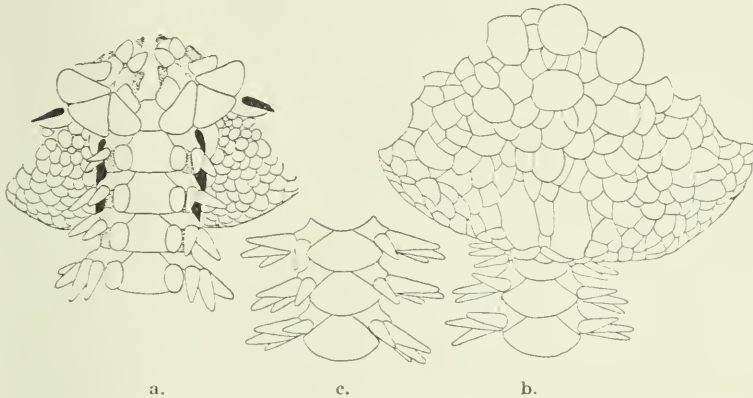


Fig. 17. *Amphiura praefecta* Koehler. — a. Part of oral side; b. of dorsal side; c. three armjoints from middle of arm, dorsal side. <sup>18</sup>/<sub>1</sub>.

edge. The oral shields are generally triangular, but the outer edge is sometimes more convex than shown in the figure. The radial shields may be contiguous in the outer part. The primary plates in younger specimens join completely, with no small plates between them, thus forming a very conspicuous rosette.

The species, although apparently not viviparous, shows some unusual features in the arrangement of its genital organs. There is, in both sexes, only one gonad to each bursa, situated at the interradian side; the eggs are large and yolky and do not all ripen at the same time, as is the rule in non-viviparous forms, but one after another, as is the case in viviparous forms. This is so remarkable and exceptional that one cannot help suggesting that it may, however, ultimately prove to be viviparous; the fact that the

eggs ripen one after another, and consequently must be laid one after another, is not in favour of assuming that some sort of care of the brood exists, the rule in other Echinoderms which protect their brood being that the eggs are laid simultaneously.

The species was first found at Campbell Island by Filho, the single specimen secured by him remaining undescribed until Koehler undertook a revision of the Ophiuroid-Collection of the Paris Museum (1907). Through the present author's researches it has now been shown to occur also at the Auckland Islands. The fact that it has not been found in other localities would seem to indicate that it is endemic to the subantarctic region of New Zealand.

## 22. *Amphiura aster* Farquhar.

Figs. 18-19.

*Amphiura aster*. Farquhar. 1901. Description of a new Ophiurid. Trans. N. Z. Inst. XXXIII.

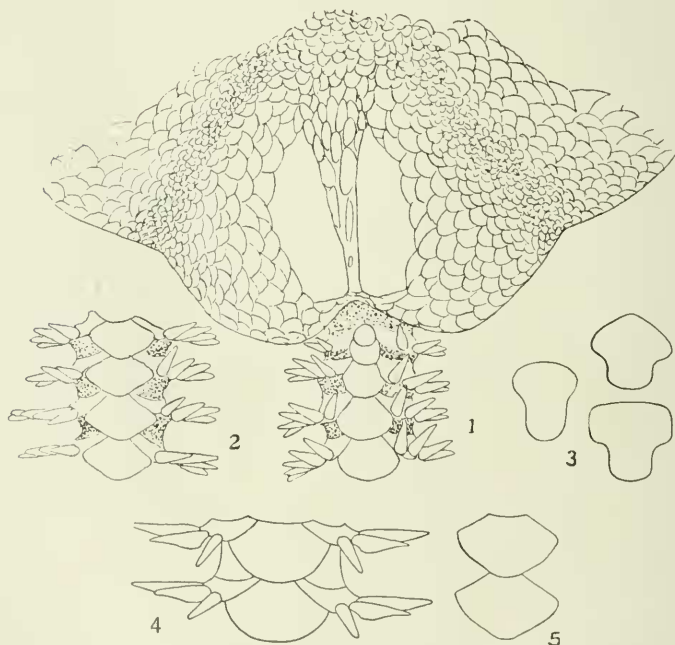


Fig. 18. *Amphiura aster* Farquhar. -- 1. Part of dorsal side; 2. four armjoints from middle of arm, dorsal side; 3. various forms of mouthshields; 4. two armjoints, from another specimen, dorsal side; 5. two dorsal plates from yet another specimen. <sup>12/4</sup>.



- ?*Amphiura aster*. Koehler. 1907. Revision de la collect. des Ophiures du Mus. d'Hist. nat. Paris. Bull. sc. Fr. et Belgique XLI. p. 299. Pl. XI, 15—16.
- *arenaria* Farquhar. 1913. On two new Echinoderms. Trans. N. Z. Ins. XLV. 214. Pl. IV.
- — H. Lym. Clark. 1915. Catalogue Rec. Oph. p. 224.
- *aster* — Ibidem. p. 224.

No specimens were collected by the author, but a few specimens of *A. arenaria* from Plimmerton were sent to me by Mr. Farquhar in 1912, and a pair of specimens of *A. aster* (unfortunately in a very poor state of preservation) from Timaru, the type locality of this species, were presented to me by Mr. W. R. B. Oliver. Also a pair of specimens of *arenaria* (again from Plimmerton) were sent me from the Dominion Museum, Wellington.

On studying these specimens I find that they all belong to one and the same species, and there can be no doubt, accordingly, that *Amph. arenaria* is a synonym only of *A. aster*. Farquhar has also himself called attention to the close relation between *arenaria* and *aster*, but thinks the differences in the scaling of the disk and the shape of the mouth parts sufficient for separating them as two different species. As

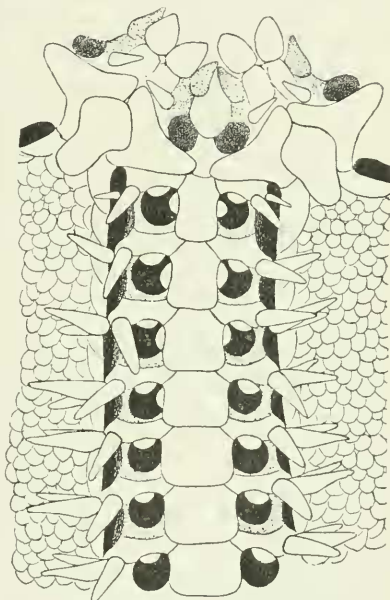


Fig. 19. *Amphiura aster* Farquhar. Part of oral side. <sup>13</sup>/<sub>1</sub>.

regards the scaling of the disk there is, however, so considerable a variation that it is quite out of question to find a reliable distinguishing character herein. The same I find to hold good for the shape of the mouth parts. Especially, I find the oral shields exceedingly variable in form, as shown in figures 18,<sub>3</sub> and 19. No other differences existing between the two forms, I do not hesitate in declaring them identical.

Regarding the characters of this species I would point out the fact, already observed by Farquhar, that two tentacle scales are

found only on a few of the proximal joints; farther out generally only one scale remains, sometimes placed on the side plate (as in fig. 19), sometimes in the corner between the side plate and the ventral plate, as usual in species where only one scale is found. The ventral plates gradually change in form, from narrow, elongate, about twice as long as wide, in the inner part of the arm, to rectangular, almost twice as wide as long, farther out (Fig. 19). The dorsal plates are, generally, more or less fanshaped, but upon the whole rather variable in shape; the proximal ones are rudimentary or, partly, absent, as pointed out by Farquhar. (Fig. 18.1-2, 4-5). Some of the armspines show the characteristic feature of having a widened, slightly serrate distal edge in the basal part (fig. 18.4); this feature is especially distinct on the second spine from below, and, apparently, does not occur on the lowermost or the uppermost one. The lowermost spine is slightly curved.

The figures of *Amph. aster* given by Koehler (Op. cit.) offer so conspicuous differences from the characters to be observed in this species that they must either be very diagrammatic or represent another species.

The eggs are fairly large, ca. 0.15—0.18 mm, which may perhaps indicate that this species has not a typical *Ophiopluteus*-larva.

### 23. *Amphiura noræ* Benham.

*Amphiura noræ*. W. B. Benham. 1909. Sci. Res. N. Z. Governm. Trawling Exp. 1907. Echinodermata, p. 22. Pl. X.1-3.

This species, — besides *Ophiocormus notabilis* the only New Zealand Ophiurid not examined by the present author, — is very well distinguished from the other New Zealand *Amphiura*'s through its two tentacle scales and the nearly naked underside of the disk.

I have no remarks to offer to the careful description and figures given by Benham.

### 24. *Amphiura rosea* Farquhar.

Fig. 20.1-7.

*Amphiura rosea*. Farquhar. 1894. Description of a new species of Ophiuridæ. Trans. N. Z. Inst. XXVI. p. 110. Pl. IX.

— — Farquhar. 1898. On the Echinoderm Fauna of New Zealand. Proc. Linn. Soc. N. S. Wales. p. 308.

*Amphiura rosea*. H. Lyman Clark. 1915. Catalogue Recent Ophiurans; p. 231.

— *parva* Hutton. H. Lyman Clark. Ibidem, p. 230. Pl. V, figs. 10—11.

Wellington Harbour, c. 5 fms; mud. 16/II.15. 3 specimens.

Queen Charlotte Sound, 3—10 fms; mud. 19—20/I.15. 2 specimens.

Off Bare Island, 35 fms; mud, clay. 17 XII.14. 1 specimen.

Off Tiri-Tiri, Auckland, 15 fms; mud. 28/XII.14. Numerous specimens.

To the very careful description of this species given by Farquhar only a few remarks need to be added. Reference must

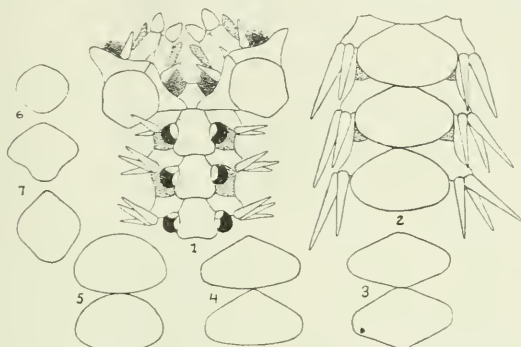


Fig. 20. *Amphiura rosea* Farquhar. — 1. Part of mouth and oral side of arm; 2. three armjoints from middle part of arm, dorsal side; 3—5. various shapes of dorsal plates; 6—7. various shapes of mouthshields. All figures  $\frac{1}{2}$  nat.

also be made to his careful figures; only a few details it is desirable to figure here.

The oral shields are stated by Farquhar to be circular, usually with a slight peak within. I have found a considerable variability in regard to the shape of the oral shields, the nearly circular form being met with more rarely. The usual form I find to be that with a slight restriction near the outer edge (Fig. 20,1). The adoral shields sometimes join completely proximally to the oral shield; they may prolong outwards so as to reach the genital slit, but equally often they have no such prolongation (Fig. 20,1). The outer mouthpapillæ I have sometimes found to be bifid. The arms, which are very long and slender, ca. 15 times the diameter of disk, are somewhat flattened and slightly increasing in width, thus being somewhat more slender close to the disk than farther out, and then very gradually tapering towards the end. The dorsal plates may vary

rather considerably in shape (Fig. 20.2-6). As remarked by Farquhar there is not rarely only one tentacle scale at some of the proximal pores.

The numerous specimens from off Tiri-Tiri have nearly all of them lost their original reddish colour on being preserved in alcohol; only a few of them have remained much darker than the rest.

The eggs are small, ca. 0,07-0,08 mm, which fact tends to indicate that this species will prove to have a typical Ophiopluteus-larva.

The species having hitherto been recorded only from Wellington Harbour and Foveaux Strait (H. Lym. Clark, op. cit.), it is of interest to find it so widely distributed in the New Zealand seas, in some places even occurring in great numbers.

The species mentioned and figured by H. L. Clark in his Catalogue of the Recent Oph. (loc. cit.) under the name of *Amphiura parva* Hutton is not that species (which latter has been shown by Benham to be *Amphipholis squamata*) but *Amphiura rosea* Farqu. I can state this, having had, through the kindness of my friend H. L. Clark, one of his specimens for examination.

Farquhar thinks this species nearly related to *Amph. bellis* Lyman from the Japanese seas. I am inclined to think it more nearly related to *Amphiura Eugeniæ* Ljungm. from the South American seas (the Fuegian region) and from off Kerguelen. I do not think, however, that it is identical with the latter species. Especially the shape of the oral shields, although very variable in *A. eugeniæ*, as shown by Koehler<sup>1)</sup> seems to afford a distinct distinguishing character, being upon the whole more elongate and spearshaped in *A. eugeniæ*, shorter and more rounded in *A. rosea*.

#### 25. *Amphiura eugeniæ* Ljungm. var. *latisquama* n. var.

Fig. 21.a-c.

Among the Ophiurids from New Zealand, brought home by the author, there is a single specimen of an *Amphiura*, in a very poor state of preservation (dried), labelled only New Zealand. I am not quite sure how I have got it, but it is presumably one of the Echinoderms presented to me by Mr. W. R. B. Oliver, and therefore probably was found in the neighbourhood of Auckland.

<sup>1)</sup> See under the following species.

The specimen shows a very close resemblance to *Amphiura eugeniæ* Ljungman. In view of the great variations shown by Koehler<sup>1)</sup> to occur in this species, especially as regards the shape of the oral shields, I do not think the small differences from the typ-

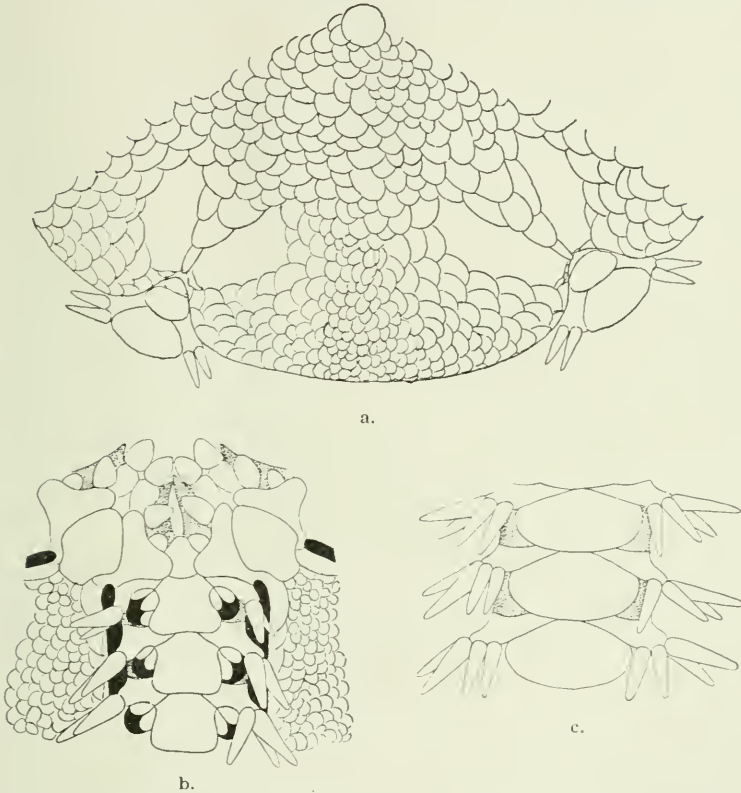


Fig. 21. *Amphiura eugeniæ*, var. *latisquama*. — a. Part of dorsal side; b. of ventral side; c. three armjoints, from middle part of arm, dorsal side. a.  $\frac{10}{1}$ ; b.—c.  $\frac{10}{1}$ .

ical form (from Kerguelen) to be observed in this specimen sufficient for maintaining it as a separate species. It seems to me preferable — until more and better material enables us to form a better judgment of the value of these differences — to designate it as a variety only of *Amphiura eugeniæ*; thus the undeniable close relation to the said species is emphasized.

<sup>1)</sup> R. Koehler. Échinodermes (Astéries, Ophiures et Échinides) recueillis par M. Rallier du Baty, aux îles de Kerguelen, en 1913—1914. Ann. de l'Inst. Océanogr. VII. 1917. p. 63. Pl. VIII, figs. 1—9.

The New Zealand specimen (Figs. 21.a.—c.) differs from the Kerguelen form in the character of the ventral plates, which are somewhat shorter and wider than generally in the typical *A. eugeniæ*; also the characteristic form of the proximal ventral plate, shown in the figure, affords a character distinguishing it from *A. eugeniæ*. The shape of the oral and adoral shields is almost exactly similar to that of *A. eugeniæ* seen in Pl. VIII, fig. 8 of Koehler's work. The outer mouth papilla appears to be generally more scale-like in *A. eugeniæ* than in the New Zealand form, but in Koehler's Pl. VIII, fig. 9 the shape of this papilla is very much like that of the New Zealand form. A noteworthy feature of the New Zealand form is the presence of a small papilla outside the normal outer papilla; such papilla is not observed in any of Koehler's figures of *A. eugeniæ*, and not mentioned in the text either.<sup>1)</sup> If this papilla proves to be a constant feature in the New Zealand form I would be inclined to ascribe some importance to it. — The radial shields are very small, widely divergent; they do, however, not differ much from those in Pl. VIII, fig. 5 of Koehler's work, less so than those of another specimen of *A. eugeniæ* represented in Fig. 1 on the same plate in Koehler's work. The shape of the dorsal plates may perhaps prove slightly different in the two forms, but I cannot ascribe much importance to a small difference herein. — The tentacle scales are regularly two in the whole of the arm fragment preserved; some of the proximal pores have three scales, as has also been observed in *A. eugeniæ* by Koehler.

I may take the opportunity here of pointing out that also *Amphiura mortenseni* Koehler appears to be very closely related to *A. eugeniæ* and perhaps cannot be maintained as a distinct species. At least, a comparison between the figures of *A. eugeniæ*, given by Koehler in the work on the Echinoderms of Kerguelen quoted above, and those of *A. mortenseni*, given by Koehler in his report on the Ophiuroids of the Australian Antarctic Expedition, Pl. 80, figs. 5—8 conveys the impression that these two species are so closely related as to be hardly distinguishable from each other.

<sup>1)</sup> In one of some specimens of *A. eugeniæ*, kindly sent me by Prof. Koehler, I find a trace of this small outer papilla at one side of one of the mouth corners.

26. *Amphiura amokuræ* n. sp.

Figs. 22.a-c.

Perseverance Harbour, Campbell Island; under stones, at low water.  
S.XII.1914. 2 specimens.

North Cape, New Zealand; under stones, at low water. 3/I.1915. 1 specimen.

Diameter of disk 5 mm, length of arms 4—5 times the diameter of the disk. The scales of the aboral side of the disk rather coarse, somewhat irregular, round the radial shields more regular, imbricating; the primary plates are distinct. The radial shields are

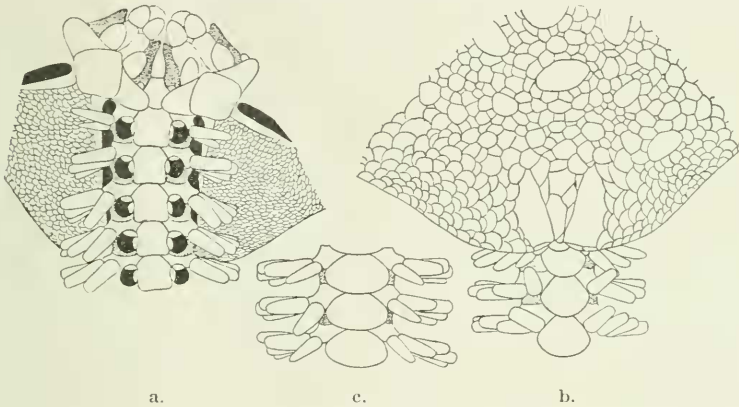


Fig. 22. *Amphiura amokuræ* Mrtzn. — a. Part of oral side; b. of dorsal side; c. three armjoints from middle of arm, dorsal side. <sup>13</sup>/<sub>1</sub>.

small, only ca.  $\frac{1}{3}$  of the disk radius; they are diverging, completely separated by several irregular scales. The oral side of the disk has a complete covering of very fine scales. The oral papillæ are large, oval, not spiniform; sometimes a very small papilla is found distally to the large papilla. The oral shields are almost rhomboidal, with only a small outer lobe. The adoral shields do not meet within and, as a rule, do not reach the genital slits. The ventral plates are about equally wide and long, with their lateral and distal edges slightly concave and the outer corners rounded. Two small tentacle scales. The dorsal plates are in the proximal part of the arm somewhat elongate, fanshaped, about as long as wide, farther out more oval, nearly twice as broad as long. The arm spines are short, outstanding, distinctly flattened; there are six, sometimes seven, in

the proximal part of the arm, the number gradually decreasing towards the point of the arm.

The eggs are rather small, only c. 0.1 mm.

The specimen from North Cape differs from those from Campbell Island in having much finer scales on the aboral side of the disk, the central plate alone remaining distinct; also the radial shields are a little smaller and narrower. As I do not find any other characters by which to distinguish it from the typical form, I do not hesitate in referring it to the same species. If the differences noted in the scaling and the radial shields prove constant, it may well be distinguished as a separate variety — but the material available does not allow judging of the constancy of this feature.

The species shows a considerable resemblance to *Amphiura incana* Lyman, from Cape of Good Hope. ("Challenger" Ophiuroidea, p. 128, Pl. XXXIII, figs. 5—7). The broad outer oral papilla of *A. incana* and the different configuration of the oral and adoral shields would appear, however, to afford good distinguishing characters, to which must be added the difference in the shape of the ventral plates which are — judging from the figure given by Lyman — distinctly broader in *incana* than in *amokurae*, and the number of the spines, eight in *incana*, six (seven) in *amokurae*. These differences would seem to put the specific distinctness of the two forms beyond all doubt.

After this was written I received from Professor Benham two specimens of this species, dredged in Otago harbour, 2 fms; VI. 1923. They agree very well with type specimens from Campbell Isl., only the arms are somewhat longer, ca. 7 times the diameter of the disk. Also a young specimen from Lyall Bay and one from Timaru, collected by Mr. W. R. B. Oliver in 1907, prove to belong to this species. — It is very satisfactory thus to have demonstrated the occurrence of the species at the coast of the South Island of New Zealand. This fact, together with the above statement of its occurrence at North Cape, leaves no doubt that it will prove to occur all along the New Zealand coasts.



27. *Amphiura alba* n. sp.

Figs. 23, a-c.

Colville Channel, 35 fms; sandy mud. 21/XII.14. 4 specimens.

Diameter of disk 4 mm; length of arms 4—5 times the diameter of the disk. The scales of the disk on the aboral side fairly large, those on the oral side much finer, but forming a complete covering. The primary plates not very distinct; the radial shields

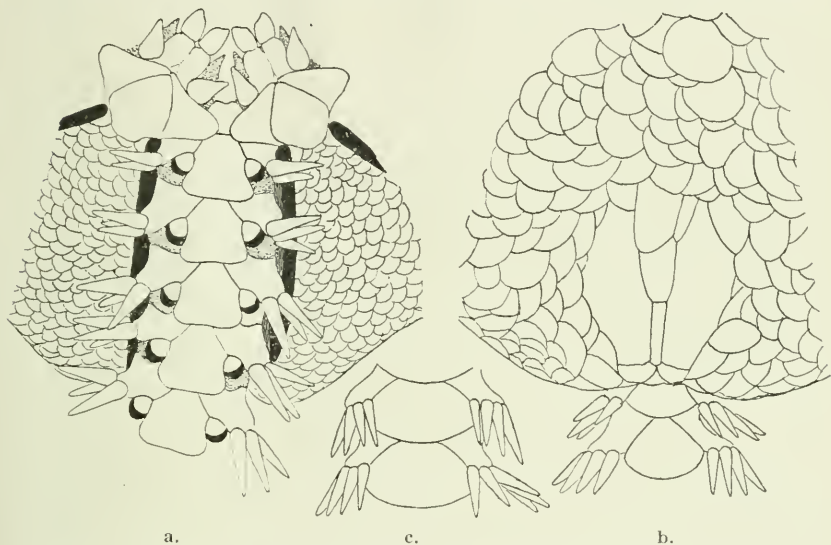


Fig. 23. *Amphiura alba* Mrtsn. — a. Part of oral side, b. of dorsal side; c. two armjoints from middle of arm, dorsal side.  $\frac{20}{1}$ .

rather broad, not quite as long as half the disk radius; they are diverging and may be separated by a narrow wedge of scales or join in their outer part. The outer oral papilla broad, but pointed, thus evidently of the spiniform type. The oral shields are about spear-shaped, somewhat longer than broad. Adoral plates just meeting within, sometimes excluded from the genital slit. The ventral plates are distinctly broader in their outer part, the outer edge being slightly concave. One small triangular tentacle scale. The dorsal plates are broadly contiguous, with the aboral edge slightly convex; they are distinctly broader than long. The basal armjoints carry 6 short slender spines; farther out the number diminishes, as usual, to 5—4, and 3 at the end of the arm. They do not

stand out at a right angle to the arm, as is the case in the preceding species. The two ventral spines are slightly longer than the others.

The colour is white, somewhat shining, especially in the oral region. The eggs are very small and numerous; it may thus be inferred that it has typical pelagic larvæ.

This species appears to be nearly related to *Amph. angularis* Lym. occurring at Kerguelen (cf. Koehler. Échinodermes, recueillis par M. R. du Baty, aux îles de Kerguelen, en 1913—14. Ann. Inst. Océanogr. VII. 1917. p. 67. Pl. VIII, figs. 13—15). In fact, it is only the different number of arm-spines (4—3 in *angularis*, 6—5 in *alba*) and the different character of the dorsal plates (broadly in contact in *alba*, scarcely so in *angularis*) which appear to form distinguishing characters. This is, however, sufficient for showing that they cannot simply be regarded as identical. Also to *Amph. constricta* it bears a considerable resemblance; but the fact that this latter species is viviparous at once proves that these two forms are not identical.

## 28. *Amphiura hinemoæ* n. sp.

Figs. 24, a—d.

Off White Island (37° 40' S. 177° 1' E.), 55 fms; sandy mud. 19/XII.14.  
2 specimens.

Disk covered by numerous rather fine scales, among which the six primary plates are distinct, through their somewhat larger size and through having a whitish spot in the middle, surrounded by a darker ring, due to a special structure of this part of the plate. The radial shields are narrow and elongate, equalling half the radius of the disk in length; they are separated throughout their length. The underside of the disk is naked, the limit between the naked part and the scales along the border being quite sharp; a few larger scales are found along the genital slits. The outer mouth papilla is somewhat leafshaped, not simply spiniform. The oral shields are, in the larger specimen, rhomboidal, in the smaller specimen almost triangular, with outer edge rounded. Adoral plates rather narrow, meeting within. The ventral plates are somewhat elongate, with outer edge slightly concave and the outer corners rounded. The first fully formed ventral plate is distinctly broader

in the distal than in the proximal part; outside the disk they are in contact merely with the point. Only one small tentacle scale. The dorsal plates are transverse oval with an obtuse point inwards, not in mutual contact. Three subequal armspines, about as long as an armjoint. Colour of the dried specimens white.

The larger specimen, measuring 4 mm diameter of disk, has all five arms broken; in the smaller specimen, 3 mm diameter of disk, the arms are about 5—6 times the diameter of disk.

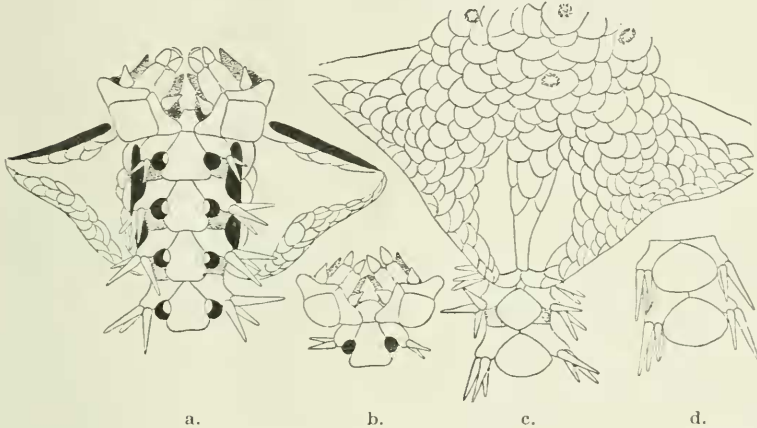


Fig. 24 *Amphiura hinemow* Mrtsn. — a. Part of oral side; — b. part of mouth and proximal armjoint of smaller specimen; — c. part of dorsal side; -- d. two armjoints from middle of arm, dorsal side.  $\frac{10}{1}$ .

The eggs are not large, 0,15 mm. Apparently they do not all ripen at the same time, which might well indicate that the species has not typical pelagic larvæ. However, the material in hand is rather too insufficient for giving this conclusion a reasonably firm base.

Among the small group of *Amphiuras* with one tentacle scale, three spines and naked underside of the disk *A. seminuda* Ltk. & Mrtsn. and *A. carchara* H. L. Clark, both from the North Pacific, are evidently nearly related to the present species. From the former (known only from the mouth of the Gulf of California) it is distinguished through the different shape of the outer mouthpapilla (spiniform in *seminuda*), through the different shape of the radial shields (broadly joining in *seminuda*) and through the primary plates,

which are not visible in the latter species. In *A. carchara* the outer mouthpapilla is also long and spiniform and there would appear to be some differences between *A. hinemoa* and *carchara* also in the scaling of the disk (primary plates not seen in the latter) and in the shape of the dorsal plates. — These differences are not very important, it is true, but by the great geographical distance it would be quite unjustifiable to regard the New Zealand form simply as identical with the North Pacific form, since there are distinct differences. Especially, I should think the shape of the outer mouthpapilla a valuable character.

29. *Amphiura annulifera* n. sp.

Figs. 25. a-c.

Plimmerton, under stones, at low water. 15/I.1915. 2 specimens.

Diameter of disk, 3 mm, length of arms ca. 3 times the diameter of the disk. The scales in the middle of the aboral side of the disk rather coarse. The central plate distinct, but the other primary plates indistinguishable; towards the edge of the disk the scales are conspicuously smaller than in the middle. The scales on the oral side of the disk very fine. The radial shields are small, separated, divergent, equalling only  $\frac{1}{3}$  of the disk radius. The outer oral papilla fairly large, not spiniform. The oral shields are triangular, with slightly rounded sides; adoral shields meeting within and adjoining the inner border of the genital slit with their outer edge. The ventral plates are elongate, somewhat longer than broad, with the sides almost straight and the outer edge slightly concave, outer corners rounded; the proximal end truncate. One small, but distinct tentacle scale; pores small. The dorsal plates are fan-shaped, with the proximal end truncate, somewhat wider than long. 4 short, cylindrical spines, of almost equal length. Genital slits narrow.

The two specimens show a characteristic coloration, viz. a brownish ring round the mouth, across the mouth angles, proximal to the outer oral papilla; the species name refers to this feature. Otherwise they have no coloration.

This small species is viviparous, two fairly large young ones being found in the one specimen, which was sacrificed for anatomical study. It disclosed the very important and interesting feature

of being hermaphroditic, as the author has shown nearly all viviparous Ophiurids to be.<sup>1)</sup> It was found to have one testis at the adradial side and one ovary at the interradiial side of each genital slit. The eggs are fairly large, ca. 0,3 mm, full of yolk.

The two specimens were found together with, and under the same conditions as *Amphipholis squamata*, and may well be supposed to be of not rare occurrence in such localities as those, where the latter species is found.

This species appears to be nearly related to the Australian *Amphiura constricta* Lym., from which it differs, however, besides

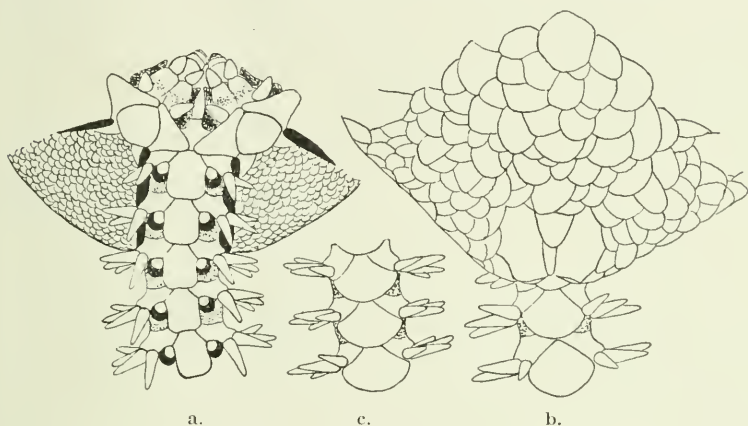


Fig. 25. *Amphiura annulifera* Mrtsn. a. Part of oral side, b. of dorsal side; c. three armjoints from middle part of arm, dorsal side.  $\frac{22}{1}$ .

in some minor details (tentacle scales larger, more elongate, dorsal armplates somewhat shorter and broader, radial shields somewhat more elongate in *A. constricta*) in the anatomical relations of the genital organs, *A. constricta* having both ovary and testis on the same, interradiial side of the genital slit.

Also to the antarctic *Amphiura algida* Koehler the present species shows a considerable resemblance, but still differs so much from it in various minor points that their specific identity is out of question. It is unknown whether *A. algida* is also viviparous.

<sup>1)</sup> Th. Mortensen. On hermaphroditism in viviparous Ophiurids. Acta Zoologica. I. 1920.

30. *Amphiura pusilla* Farquhar.

Figs. 26.1—2.

*Amphiura pusilla*. H. Farquhar. 1897. A contribution to the history of N. Z. Echinoderms. Journ. Linn. Soc. Zool. XXVI. p. 191. Pl. XIV. figs. 1—3.

— — H. L. Clark. 1915. Catalogue Rec. Ophiurans. p. 235.

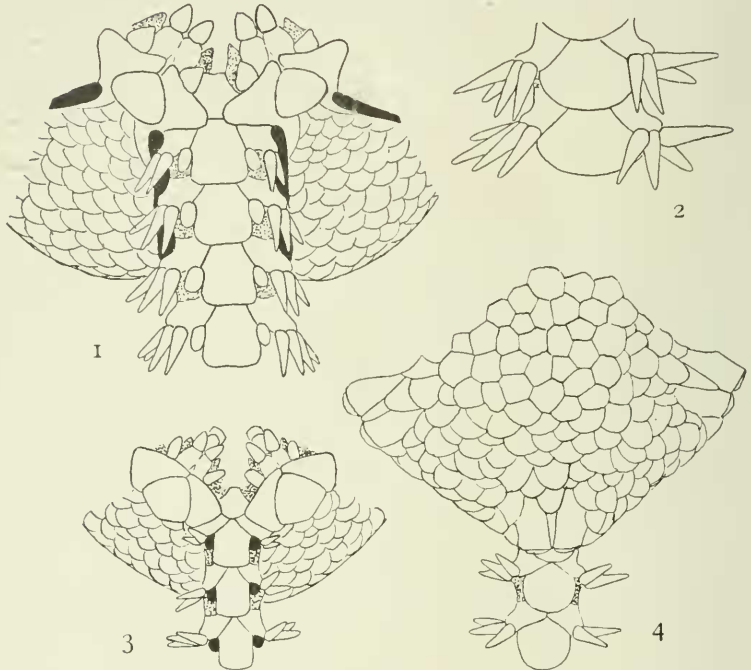


Fig. 26. 1—2. *Amphiura pusilla* Farquhar.  $30/1$ . 3—4. *Amphiura* sp.  $26/1$ . 1. and 3. part of oral side; 2. and 4. part of dorsal side.

Island Bay, Wellington. 22/1.1915. 1 specimen.

Wellington Harbour, 5—10 fms. Hard bottom. 16/II.1915. 1 specimen.

Otago Harbour. VII.1923. 1 specimen (received from Professor Benham).

All three specimens are in a poor condition. Still they are sufficient to enable me to give a little additional information about this species. They are all small, the largest scarcely 3 mm diameter of disk. Arms all broken.

The figure of the ventral side of this species given by Farquhar is not quite satisfactory, the shape of the mouthshields as well as of the ventral plates not being very well represented. In

my three specimens I find these plates to have the shape given in Fig. 26.1. Also the mouth parts are not quite satisfactorily represented in the said figure in Farquhar's paper. Farquhar's statement that the first tentacle scale is long and spiniform probably refers to the inner mouth papilla; the tentacle scales proper are all rounded, leaf-like, as shown also in Farquhar's figure.

I can give no information as regards the propagation of this species. It would especially be very interesting to know whether it is viviparous or not — but the solution of this question requires much better material than that at present available. — The species was hitherto found only at Wellington. As pointed out by Farquhar this species is very closely related to *Amph. constricta* Lyman. In fact, I am rather inclined to think that they are really the same species. But until we know whether *A. pusilla* is also viviparous and hermaphroditic like *A. constricta* we must keep them as separate species.

### 31. *Amphiura* sp.

Figs. 26.2-4.

A single small specimen of an *Amphiura*, dredged in a depth of 50 fathoms, 10 M. N.W. of Cape Maria van Diemen, on hard bottom (5/1.1915) very probably represents a hitherto unknown species. It is, however, too young for stating this definitely; but it is so characteristic, especially through the arrangement of the scales on the dorsal side of the disk that it will probably be perfectly recognizable, and I have therefore thought it worth while describing and figuring it.

Diameter of disk 2 mm, length of arms ca. 10 mm. The scales in the middle of the aboral side of the disk uniform, polygonal, arranged like a regular mosaic. Towards the edge of the disk the scales gradually become overlapping. No central or other primary plates to be distinguished. Radial shields small,  $\frac{1}{3}$  the length of the disk radius, separated, divergent. The oral side of the disk covered with fairly large, overlapping scales. Genital slits not yet distinct. The oral shields are triangular with rounded sides; adoral plates meeting within. Outer oral papilla fairly broad and long, apparently not spiniform. The ventral plates are elongate, with nearly straight sides, outer edge rounded. Tentacle scales not yet

developed, only at one pore a single triangular scale is found, which would seem to indicate that this species belongs to the group of *Amphiura*'s with one tentacle scale only. The proximal dorsal plates somewhat elongate, farther out they are shorter, more rounded, separated from one another. Three short, cylindric, subequal arm-spines.

The characteristic scaling of the dorsal side of the disk recalls *Amphioplus basilicus*; also the ventral plates and the oral parts bear a considerable resemblance to that species, as seen on a comparison with fig. 28. The lacking of the tentacle scales evidently is due to the specimen being too young for yet having them developed and, therefore, might not be sufficient reason for not simply referring this specimen to *Amphioplus basilicus*. But the single outer oral papilla is so important a character, scarcely to be accounted for by the young age of the specimen alone, that it is out of question to identify the specimen with that species. (The youngest specimen of *A. basilicus* in hand, scarcely 2 mm diameter of disk, already has the mouth papillæ typically developed). Also the arms are very much shorter in *A. basilicus* of a corresponding size, only ca. 3 mm against ca. 10 mm in the present specimen. Upon the whole, it is out of question that these two forms could be more nearly related, in spite of the conspicuous resemblances pointed out above.

### 32. *Amphiocnida pilosa* (Lyman).

Figs. 27.1—10.

- Ophiocnida pilosa*. Lyman. 1882. Challenger Ophiuroidea, p. 153. P. XIX.7—9.  
 — — H. L. Clark. 1909. Sci. Res. Trawling Exped. "Thetis" Mem. Austral. Mus. IV. p. 541.  
*Amphiocnida* — A. E. Verrill. 1899. Revision of certain families and genera of West Indian Ophiurans. Tr. Conn. Acad. X. p. 318.  
 — — H. L. Clark. 1915. Cat. Recent Ophiurans, p. 237. Colville Channel; 35 fms; sandy mud. 21/XII.14. 8 specimens.

Several minor points of difference existing between the specimens from New Zealand and the type of this species (from Bass Strait) as described and figured by Lyman (Op. cit.), tend to make the referring of the New Zealand form to this species somewhat uncertain. However, the very great variability exhibited by



the specimens according to size, and the fact that they cannot be distinguished with certainty from specimens from the N. S. Wales

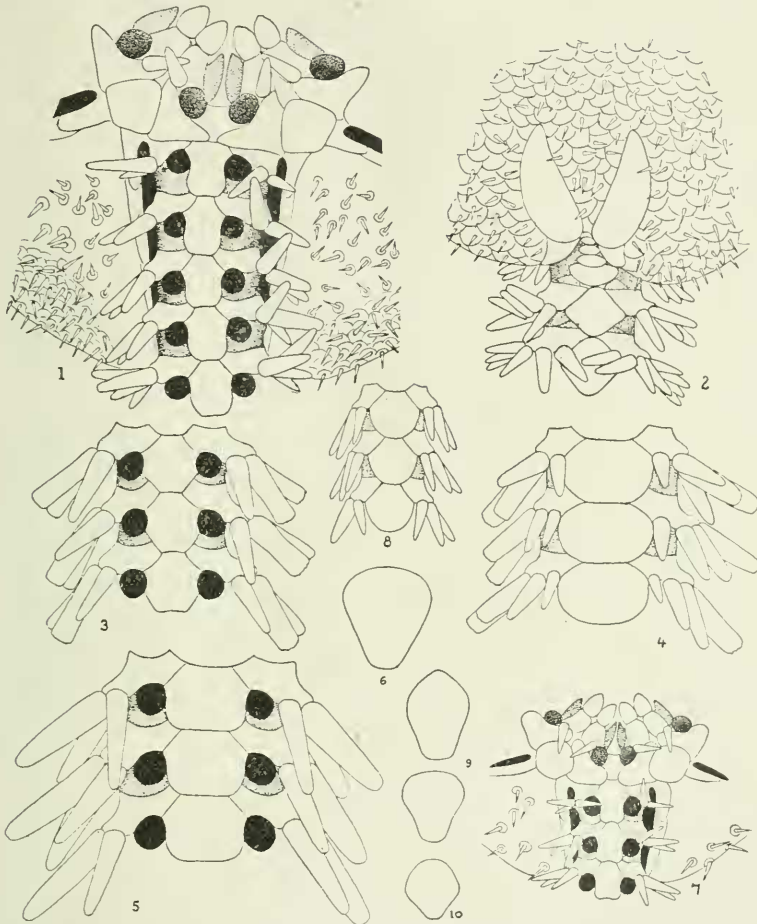


Fig. 27. *Amphiocnida pilosa* Lyman. — 1. Part of oral side; 2. of dorsal side; 3 and 4. three armjoints from middle of arm, showing shape of ventral and dorsal plates. Same specimen as 1—2 (7 mm). 5. three armjoints of a larger specimen (11 mm) showing different shape of ventral plates; 6. mouthshield of same specimen; 7. part of oral side of a small specimen (4 mm); 8. three armjoints from same specimen, dorsal side; 9—10. different shapes of mouthshield from specimens from off the N.S. Wales coast. All figures  $12/1$ .

Seas would seem to make it unjustified to maintain the New Zealand form as a separate species. Whether the N. S. Wales specimens really belong to the species described from the Bass Strait

is another question; but here, again, I am inclined to think so, in spite of the differences which can be pointed out. The fact that H. L. Clark, who had a cotype of Lyman's *Ophiocnida pilosa* for comparison with his specimens, does not hesitate in declaring them identical, makes me the more confident that both the New Zealand and the N. S. Wales form really belong to this species.

As appears from the figures given here, the specimens differ so considerably according to age that, if they had not been taken all together in the same haul, one would hardly think of regarding them as belonging to one and the same species. It is mainly the shape of the ventral plates which differs so conspicuously. In a specimen of 4 mm diameter of disk (Fig. 27.7) they are narrow, elongate, distinctly longer than broad, the basal part being somewhat broader than the outer part. In a specimen of 7 mm diameter of disk they have mainly the same character in the proximal part of the arm, but farther out they get a very characteristic polygonal shape, narrowing in their outer part (Fig. 27.1, 3); finally in the largest specimen, 11 mm diameter of disk, they are almost regularly rectangular, distinctly broader than long (Fig. 27.5). The same transformation of the ventral plates according to age is to be observed in the N. S. Wales specimens. The difference in the shape of the dorsal plates in smaller and larger specimens, as shown by figs. 27.8 and 4, though no less striking, is not so surprising. It may be pointed out that generally the first complete dorsal plate is rhomboidal.

The armpines are in the larger specimens 7—9 in the proximal part of the arm; in the smaller specimens there are only five, as in the type. They are more or less distinctly flattened, sometimes slightly widened and dentate at the point (Fig. 27.3-4), but this is no constant feature. Generally the lowermost one is the longest, and sometimes also the upper one or two are somewhat longer than the middle ones; but, again, this is not constantly so. The radial shields are generally contiguous in the outer part, but sometimes they are wholly separate (Fig. 27.2). The mouth shields are very variable in shape, as is also the case in the specimens from off the N. S. Wales coast (Fig. 27.1, 6, 9-10); the form of mouth shields seen in Fig. 27.1 I have, however, not observed in any of the specimens from off the N. S. Wales coast.

It is rather perplexing to find in this species so great a variation in the shape of the plates which otherwise generally afford distinguishing characters of the highest value. But we have got to agree that there is such great variation here — otherwise we should have to designate each specimen as a separate species.

The scaling of the ventral surface of the disk is, upon the whole, more sparse in the New Zealand than in the Australian form; also the spines on the disk are generally not so coarse in the former as in the latter form — but it appears to be not constant enough to justify maintaining the New Zealand form as a distinct variety.

Evidently the arms are very long. In the largest of the New Zealand specimens the longest arm is ca. 7 times the diameter of the disk, and quite a considerable length has been lost. In one of the Australian specimens the arms must have been a good deal more than 15 times the diameter of the disk.

The eggs are not very numerous and fairly large, 0,25 mm. This indicates that this species has probably not a typical *Ophiopluteus*-larva.

On the largest of the New Zealand specimens a number of specimens of a small *Loxosoma* are found attached to various places on the ventral side of the disk and arms. Also in one of the Australian specimens (37° 05' S. 150° 15' E. 30—50 fms) the same *Loxosoma* is found.

### 33. *Amphioplus basilicus* (Koehler).

Figs. 28. a—c.

*Amphiura basilica*. Koehler. 1907. Revision de la Collection des Ophiures du Mus. d'hist. nat. Paris. Bull. sci. Fr. & Belgique XLI, p. 307. Pl. XI. 17—18.

*Amphioplus basilicus*. H. Lym. Clark. 1915. Catalogue Rec. Oph. p. 257.

Carnley Harbour, Auckland Isl. 29/XI.14. 4 specimens.

Masked Isl., Carnley Harbour; Auckland Isl. 3/XII.14. 6 specimens.

Perseverance Harbour, Campbell Isl.; under stones, at low water. 9/XII.14. 18 specimens.

These specimens agree so perfectly with the description given by Koehler of the species *Amphiura basilica*, founded on three specimens from off East Cape, New Zealand (Filhol), that the identification therewith is beyond doubt.

A few remarks should be added to the description given by Koehler and also a pair of figures may not be superfluous, those given by Koehler being slightly diagrammatic.

The largest of the specimens in hand measures 4 mm diameter of disk, the arms being scarcely three times so long as the diameter of disk. As stated by Koehler, the primary plates are not distinct. It is a noteworthy fact that also in the very young specimens they are indistinct. There are some larger plates in the centre, it is true, but they are not regularly arranged in the shape

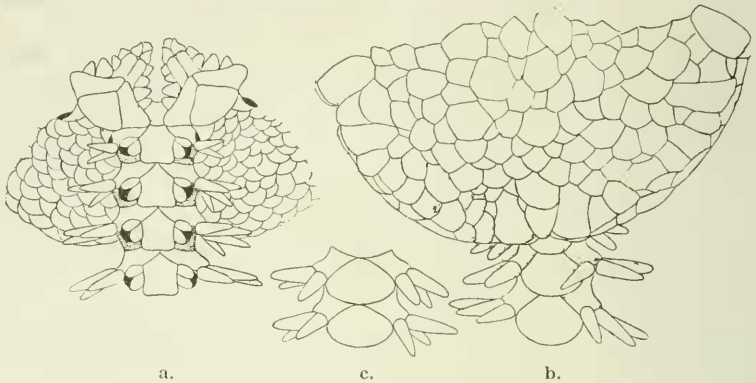


Fig. 28. *Amphioptus basilicus* Koehler. — a. Part of oral side; b. of dorsal side; c. two armjoints from middle of arm, dorsal side. <sup>13</sup>/<sub>1</sub>.

of a rosette consisting of one central plate and five radially placed plates, as it is usually seen in very young Ophiurids.

A very interesting feature is offered by the genital slits, which are very short, not reaching beyond the first armjoint. This is in contradiction with Koehler's figure, in which they are represented as large slits, reaching to the edge of the disk. In the text Koehler only says that the genital slits are narrow, without giving any statement about their length. In view of the otherwise perfect agreement of my specimens with Koehler's description of this species I could not but suppose the said figure to be erroneous in this regard and therefore asked Professor L. Joubin at the Muséum d'hist. naturelle, Paris, to lend me one of Koehler's specimens for reexamination, which he very kindly did. My suggestion proved to be perfectly justified; the genital slits were found to be quite narrow and small as in my own specimens.

Thinking that perhaps also the closely related *Amphioplus textilis* Koehler from the Magellan region might have similar short genital slits, in spite of the figure (Koehler. Op. cit. Pl. XII, fig. 35) representing them as reaching to the edge of the disk, I asked Prof. Joubin to lend me also a specimen of this species for examination. My suggestion proved to be correct, the genital slits of this species also are quite short, as in *A. basilicus*, not reaching beyond the first armjoint. — This interesting feature might perhaps justify establishing a separate genus for these two species. I shall, however, for the present, not take up a definite position as to this point.

There is only one pair of genital organs in each interradiar space; the ovaries are fairly large, containing a number of reddish 0.3 mm large eggs. This considerable size of the eggs shows almost with certainty that the development is direct, not through a typical Ophiopluteus-larva.

Some very young specimens, with only three armjoints developed, I have no doubt in referring to this species with which they agree especially in the noteworthy feature that there is no regular rosette of primary disk plates. They were found together with the adult specimens under stones, Campbell Island, 9/XII.14.

The species appears to be rather common in the littoral region at the subantarctic islands and evidently will prove to occur also at the New Zealand shores. (There is no information about the depth in which Filhol's specimens were taken.)

#### 34. *Ophionephthys stewartensis* n. sp.

Figs. 29.1—3.

Halfmoon Bay, Stewart Island; 5—7 fms; sand. 19/XI.14. 1 specimen.

Although the single specimen in hand is in a very poor state of preservation, having lost the disk, I do not hesitate in describing it as a new species, the oral and arm structures affording sufficient characters for distinguishing it not only from all other Amphiurids of the New Zealand region, but upon the whole from any other species of Amphiurids known till now.

There is a series of three papillae to each side of the mouth-edge, and a very small one in the outer corner, close to the first ventral plate. The oral shields are elongate, rounded, with slightly

reentering sides and a straight outer edge. Adoral shields almost meeting within. The ventral plates are very characteristic, elongate, a little broader within than without; the proximal one with a concave inner edge. Farther out they are almost octagonal, with a slight concavity in the outer edge. The dorsal plates are transverse oval, about twice as broad as long. Two very small tentacle scales

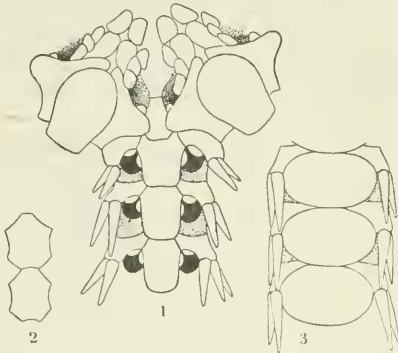


Fig. 29. *Ophionephthys stewartensis* Mrtsn.  
1. Part of mouth and proximal armjoints;  
2. two ventral plates from middle of arm;  
3. three armjoints from middle of arm,  
dorsal side. <sup>13/1</sup>.

(they are not distinct at all the pores, but this, evidently, is due to the bad state of preservation). Five or four simple spines, about as long as a joint, the middle ones slightly shorter. Whether they are naturally appressed, as in Fig. 29.3, may well be doubted. — The fact that the disk is lost, indicates that it is naked as in related species. The arms are all broken, but convey the impression of being long and slender.

This species agrees so perfectly in its oral structure and

in the shape of the ventral plates with *Ophionephthys limicola*, that I do not hesitate in referring it to the same genus.

Quite recently H. Lyman Clark<sup>1)</sup> has reestablished the genus *Ophionephthys*, which was regarded by Matsumoto as a synonym only of *Amphiura*. Clark comprises as belonging to *Ophionephthys* the group of species of Amphiurids with nearly naked disk, calcareous scales occurring only around the radial shields and rarely near the disk margin interradially, with numerous arm-spines, 5-10 on basal joints and with oral papillae as in *Amphiura*. In regard to the oral papillae, however, the type-species, *O. limicola* Ltk. (from the West Indies) does not agree with the other species, and Clark, in fact, is in doubt, whether it was not better to restrict the genus so as to include the latter species alone; since otherwise the oral papillae afford the main distinguishing characters of the genera

<sup>1)</sup> H. Lyman Clark. Brittle-Stars, new and old. Bull. Mus. Comp. Zool. LXII. 1918, p. 278.

within the *Amphiuridae*, it certainly does seem very inappropriate to unite, in this genus alone, species which, after the character of their oral structures, should otherwise be referred partly to *Amphioplus*, partly to *Amphiura* s. str.

The discovery of this new species, so closely agreeing with the type of the genus *Ophionephthys* in the important characters of the mouth parts, decidedly lends support to a restriction of the genus *Ophionephthys* to those species agreeing with the type, *O. limicola*, in regard to the oral characters. Besides the new species here described I would refer to this genus also the species described by H. Lym. Clark (Catalogue Rec. Oph. p. 253) under the name of *Amphioplus cyrtacanthus* (from the Philippines). The genus would thus also get a less remarkable geographical distribution. The other species referred by Clark to *Ophionephthys* I cannot, accordingly, regard as really belonging to that genus.

### 35. *Amphipholis squamata* (Delle Chiaje).

*Amphiura parva*. Hutton. 1878. Notes on some New Zealand Echinodermata, with descr. of new species. Trans. N.Z. Inst. IX. p. 305.

— *elegans*. Farquhar. 1897. Contr. to the history of New Zealand Echinoderms. Journ. Linn. Soc. Zool. XXVI. p. 191.

— — Farquhar. 1898. Echinoderm Fauna of New Zealand. Proc. Linn. Soc. N.S.W. p. 308.

— — Farquhar. 1907. Notes on N.Z. Echinoderms, with descr. of new species. Tr. N. Z. Inst. XXXIX. p. 125.

— *squamata*. H. L. Clark. 1909. Sci. Res. Trawling Exp. H. M. C. S. "Thetis". Mem. Austral. Mus. IV. p. 541.

— — Benham. 1909. The Subantarctic Islands of New Zealand. Echinoderms. p. 303.

— — Benham. 1911. Stellerids and Echinids from the Kermadec Isl. Tr. N. Z. Inst. XLIII. p. 152.

— — H. L. Clark 1915. Catalogue Rec. Oph. p. 242.

Non: *Amphiura parva* H. L. Clark. 1915. Catalogue Rec. Oph. p. 230. Pl. 5, figs. 10—11 (= *Amph. rosea* Farquh.).

Wellington Harbour, 5—10 fms. 16 II.15. 3 specimens.

Island Bay, Wellington; under stones, at low water. 22/I.15. 12 specimens.

Mahia Peninsula; under stones, at low water. 18/XII.14. 3 specimens.

Ponui Isl., Auckland; under stones, at low water. 24/XII.14. 2 specimens.

North Channel, Kawaii Isl., Hauraki Gulf. 10 fms. 29/XII.14. 1 specimen.

- North Cape, New Zealand; under stones, at low water., 3/I.15. 4 specimens.
- Plimmerton; 15/I.15. 3 specimens.
- Halfmoon Bay, Stewart Island; 5—7 fms; sand bottom. 19/XI.14. 2 specimens.
- Masked Island, Carnley Harbour, Auckland Isl. 3/XII.14. 12 specimens.
- Carnley Harbour, Auckland Isl.; 45 fms., sand, mud. 6/XII.14. 2 specimens.
- Further I have received from Mr. W. R. B. Oliver, 2 specimens from Cook Strait, 120 fms, collected by Mr. Hazelwood, 13/VIII.1920.

Like the authors who have previously dealt with the New Zealand form of *Amphipholis squamata* I do not find it distinguishable from typical European specimens. It is a very extraordinary fact that this small, viviparous Ophiurid should as the only one have a cosmopolitan distribution. A more profound comparative study of the whole question, based on rich material from all parts of the world, would be very desirable, and might perhaps lead to the distinguishing of local forms, or subspecies. For the present we must regard all as one species.

It is very interesting to note that one of the New Zealand specimens (Plimmerton) is infested with a specimen of the parasitic Copepod *Cancerilla*; also on one of the specimens from Carnley Harbour, 45 fms, this parasite was found. Mr. K. Stephensen, who has examined these specimens, informs me that they are not identical with *Cancerilla tubulata* Dalyell, the species infesting *Amphipholis squamata* in the European seas. This is most interesting, showing that the parasite is not so widely distributed as is its host, but replaced in the New Zealand seas by a related, but quite distinct species.

Through the present studies the group of the Amphiuroids has been shown to be very richly represented in New Zealand seas, no less than 16 (17) species having now been found there (not counting the *Ophiactis* species, as this genus, in my opinion, does not really belong to the family Amphiuroidæ, but rather forms, together with *Ophiopholis*, *Ophiopus* and a few other forms, a separate family, Ophiactidæ). As it is, upon the whole, no easy matter to identify Amphiuroids, it may be of some practical value to give here the following key to these species.



## Key to the New Zealand species of Amphiuroidae.

1. Oral papillæ forming a continuous series along each side of jaw; more than one outer oral papilla . . . . . 13.  
 Only a single outer oral papillæ, widely separated from the inner, infradental papilla; in the interval between these papillæ there is one situated at a lower level in the mouth, belonging to the first tentacle . . . . . 2.
2. Two tentacle scales, at least in the proximal part of the arm. No spines on the disk. . . . . 3.  
 Only one tentacle scale; no spines on the disk. . . . . 7.  
 No tentacle scales; spines on the disk.  
*Amphiocnida pilosa* (Lym.)
3. Two tentacle scales in the whole arm length . . . . . 4.  
 Only a few of the proximal joints with two tentacle scales, farther out only one; arms very long; 7—6 armspines.  
*Amphiura aster* Farquhar.
4. Oral side of disk naked; 4 armspines.  
*Amphiura norae* Benham.  
 Oral side of disk completely covered with scales. . . . . 5.
5. Spines (6—7) distinctly flattened.  
*Amphiura amokuræ* Mrtsn.  
 Spines not flattened. . . . . 6.
6. Oral shields spearhead-shaped, distinctly longer than wide; radial shields very small. *Amphiura eugeniæ* Ljungm.  
 var. *latisquama* Mrtsn.  
 Oral shields rounded, about as wide as long; radial shields rather long.  
*Amphiura rosea* Farquhar.
7. Oral side of disk naked. *Amphiuræ hinemoæ* Mrtsn.  
 Oral side of disk completely covered with scales. . . . . 8.
8. Lowermost spine on the middle part of the arm much elongated and slightly curved, downwards directed. . . . . 9.  
 Lowermost spine not much elongated. . . . . 10.
9. Viviparous, hermaphroditic; armspines rather coarse.  
*Amphiura magellanica* Ljungm.  
 Not viviparous; sexes separate; armspines rather delicate.  
*Amphiura spinipes* Mrtsn.
10. Tentacle scale small, triangular. . . . . 11.  
 Tentacle scale large, leafshaped. . . . . 12.

11. Viviparous, hermaphroditic; oral shields triangular; 4 armspines. *Amphiura annulifera* Mrtsn.  
Not viviparous, sexes separate; oral shields spearhead-shaped; 6—5 armspines. *Amphiura alba* Mrtsn.
12. Oral shields triangular; ventral plates wider than long, corners not rounded; 5—4 armspines.  
*Amphiura praelecta* Koehler.  
Oral shields roundly heart-shaped; ventral plates longer than wide, with rounded corners; 6 armspines.  
*Amphiura pusilla* Farquhar.
13. Outer oral papilla very broad; radial shields contiguous; viviparous, hermaphroditic.  
*Amphipholis squamata* (D. Ch.).  
Outer oral papilla not very broad; radial shields not contiguous; not viviparous, sexes separate.<sup>1)</sup> . . . . . 14.
14. Four lateral oral papillæ; oral shields short, triangular; disk on both sides completely covered with scales.  
*Amphioplus basilicus* Koehler.  
Three lateral oral papillæ; oral shields elongate, with straight outer edge. Disk (probably) nearly naked.  
*Ophionephthys stewartensis* Mrtsn.

### 36. *Ophionereis fasciata* Hutton.

Fig. 30.

- Ophionereis fasciata*. Hutton. 1872. Catalogue of the Echinod. of New Zealand. p. 2.
- — Hutton. 1872. Descr. of some new Starfishes from N. Zealand. P. Z. S. p. 811.
- *Schayeri*. Farquhar. 1895. Notes on New Zealand Echinoderms. Trans. N. Z. Inst. XXVII. p. 197.
- — Farquhar. 1898. On the Echinoderm Fauna of N. Zealand. P. L. S. N. S. W. p. 307.
- — Farquhar. 1907. Notes on N. Z. Echinoderms; with descr. of new species. Trans. N. Z. Inst. XXXIX. p. 124.
- — Benham. 1909. Sci. Res. N. Z. G. Trawling Exp. Echinodermata. Rec. Canterbury Mus. 12. p. 23.
- — Benham. 1911. Stellerids & Echinids from the Kermadec Isl. Trans. N. Z. Inst. XLIII. p. 152

Non: *Ophiolepis Schayeri*. Müller & Troschel. 1844. Beschreibung neuer Asteriden. Arch. f. Naturgesch. p. 182.

<sup>1)</sup> Genital organs and radial shields of *Ophionephthys stewartensis* unknown.

Several specimens were taken under stones, at low water, at the following localities: Mahia Peninsula; Slipper Island; Bay of Islands; North Cape; Plimmerton. Further in Queen Charlotte Sound, 3–10 fms, and in Paterson Inlet, Stewart Isl., 5–15 fms. The latter of these localities alone is of interest, the species not having hitherto been recorded from South of Dunedin.

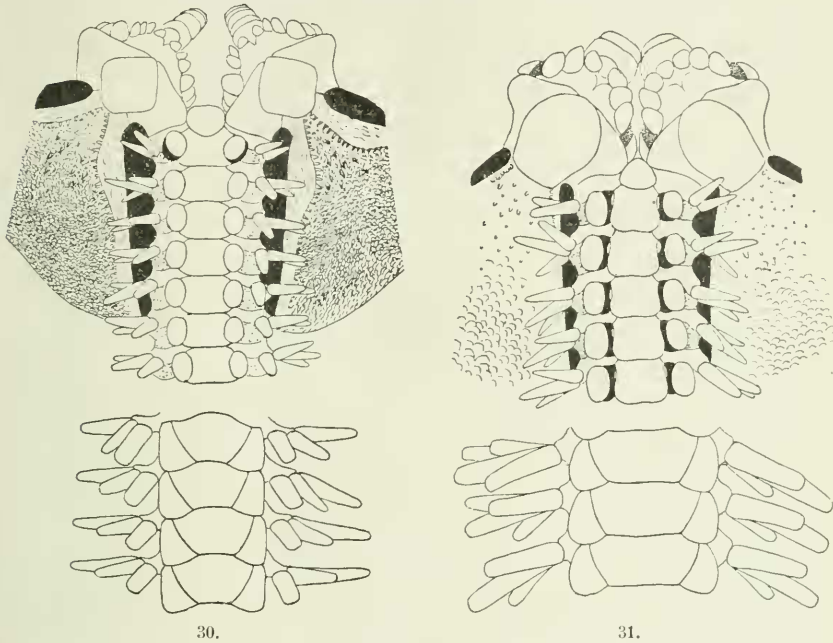


Fig. 30. *Ophionereis fasciata* Hutton. Part of oral side and four armjoints from middle of arm, dorsal side.  $\frac{2}{3}$ l. — Fig. 31. *Ophionereis Schayeri* M. & Tr. Part of oral side and three armjoints from middle of arm, dorsal side.  $\frac{5}{8}$ l.

Ever since Farquhar in 1895 declared the New Zealand species *Ophionereis fasciata* Hutton to be identical with the Australian *Ophionereis Schayeri* (Müller & Troschel) this identity has been unanimously accepted by the authors, who have dealt with these species, doubtless without having directly examined the question themselves. It is probably due to the curious fact of these forms never having been figured<sup>1)</sup> that nobody has become suspicious as to their alleged identity.

As seen on a comparison of the figures given here the two

<sup>1)</sup> Only H. L. Clark (Catalogue of Recent Ophiurans, 1915, Pl. 13.1–2) gives a pair of photographic figures of the true *O. Schayeri* (from Port Jackson); they do, however, not show any of the structural details by which this species is distinguished from *O. fasciata*.

forms are very easily distinguished, mainly through the quite different shape of the oral shields, which are distinctly rhomboidal equally long and wide, in *O. fasciata*, whilst in *O. Schayeri* they are elongate, egg-shaped, with the outer edge truncate, and distinctly longer than broad. This difference is quite constant, and equally distinct in younger and adult specimens. Further the dorsal plates are distinctly broader in *Schayeri* than in *fasciata*, the distal edge being twice the width of the supplementary plates in the Australian, only equalling the width of the supplementary plates in the New Zealand species. Also another feature appears to represent a valuable distinguishing character. In the New Zealand form the edge of the genital slits, especially at the inner end, bends outwards and looks like a sort of web, being more conspicuous on account of its white colour. There is a distinct row of small papillæ along the edge; sometimes the papillæ continue so far dorsally along the base of the arm as to get the appearance of an armcomb. The "webs" from the two genital slits in each interradian space almost meet in the midline outside the oral shield. In *O. Schayeri* and other species of this genus, this "web" is much less distinct and a wide space separates the two slits outside the oral shield. The shape of the ventral plates would appear from the two figures to differ rather considerably in the two forms; I do not, however, find the difference sufficiently constant for forming a reliable distinguishing character. The same holds good for the small inner tentacle scale seen in the figure of *O. Schayeri*. It is true, I have never observed this small scale in the New Zealand species, but, on the other hand, I have not found it constantly in the Australian form — perhaps its lacking in some specimens is due to bad preservation; but for the present, I do not venture to lay any stress on this feature as a distinguishing character. The scales of the interradia on the ventral side are somewhat larger in the Australian than in the New Zealand form, and also the proximal part of the interradia is more naked in the former than in the latter form; small spines are found on the proximal part of the interradia in both forms.

The differences here pointed out leave no doubt that the New Zealand form is a distinct species, not identical with the Australian form. The type specimen of Müller and Troschel's *Ophiolepis*

*Schayeri* being from Tasmania it could not beforehand be stated which of the two species must keep the name *Ophionereis Schayeri*. Through the kindness of the late Professor R. Hartmeyer I have had the opportunity of examining the type specimen, which is in the Berlin Museum; although it is in a poor condition there is no doubt that it belongs to the Australian form, and accordingly this latter must keep the name *Ophionereis Schayeri* (Müller & Troschel). For the New Zealand species the name *Ophionereis fasciata* Hutton must be revived.

This result, that the New Zealand form is specifically distinct from the Australian form, considerably restricts the geographical distribution of both. *O. Schayeri* is known only from Australia and Tasmania. Regarding *O. fasciata* the question remains whether it is really identical with the species of *Ophionereis* occurring at Juan Fernandez, as it is maintained by Ludwig in his report on "Die Ophiuren der Sammlung Plate" (Zool. Jahrb. Suppl. IV. 1898, p. 765). This question I am also able to solve through the kindness of the late Prof. Hartmeyer, who sent me some material of the Juan Fernandez form. I must agree that it is very difficult to find characters by which to distinguish between the Juan Fernandez and the New Zealand form. Nevertheless these forms are certainly not identical. This is proved by the fact that the eggs of the former are twice the size of those of the New Zealand species (0,2 mm against 0,1 mm); this evidently means that the development is quite different in these two forms.<sup>1)</sup> Probably the Juan Fernandez-form is also a separate species (it does not appear to me to be identical with *O. albomaculata* E. A. Smith from the Galapagos Islands). But this question does not concern us here; for the present it must suffice to have shown that the New Zealand species is not identical either with the Australian or the Juan Fernandez form and is known only from the New Zealand region.

In 1916 Professor H. B. Kirk published in the "Transactions of the New Zealand Institute", Vol. XLVIII, a short preliminary notice "On the much-abbreviated development of a Sand-star (*Ophionereis Schayeri*?)." <sup>2)</sup> His reason for referring the eggs and em-

<sup>1)</sup> This also holds good for *Ophionereis Schayeri*, the eggs of which are likewise twice the size of those of *O. fasciata*.

<sup>2)</sup> p. 383—84. Pls. XXVII—XXVIII.

bryos, which he found on the underside of stones in the Bay of Islands, Wellington, to *Ophionereis Schayeri* (viz. *O. fasciata*) are, that the terminal plate of the young Ophiurids resembles that of the said species, and that this species is very common in the neighbourhood.

Grave objections may be raised to the referring of these eggs and embryos to *Ophionereis fasciata*. Above all: the eggs of this species are very small, ca. 0,1 mm, while the eggs observed by Kirk were 0,5 mm. This small size of the eggs in *Ophionereis fasciata* almost certainly indicates that it has typical pelagic larvæ, not direct development. Further Kirk states that the tubefeet of the young Ophiurids were provided with a number of bristle-like processes; but the tubefeet of *O. fasciata* are perfectly smooth. It is, of course, possible that in the quite young newly metamorphosed specimens the tubefeet may be provided with such bristle-like processes — but it is not very probable. The terminal plate of *O. fasciata* is by no means so characteristic as to afford any proof of the identity of the embryos with this species. Finally there are other Ophiurids occurring under the stones in the same way and the same places as *O. fasciata* viz. e. g. *Pectinura cylindrica*, *Ophioplocus Huttoni*, *Ophiopteris antipodum*, *Ophiozonoida picta*, *Ophiocormus notabilis*. Any one of these species is more likely to come into consideration in the question about the parency of the directly developing embryos described by Kirk, in so far as nothing is known as yet to prevent their coming into consideration.

### 37. *Ophiozonoida picta* H. L. Clark.

Figs. 32–33.

*Ophiozonoida picta*. H. Lyman Clark. 1915. Catalogue Rec. Ophiurans. p. 340. Pl. 18, Figs. 3–4.

*Pectinura* sp. F. Jeffr. Bell. 1917. British Antarctic ("Terra Nova") Exped. 1910. Zoology. Vol IV. 1. Echinoderma, p. 6.

Off White Island (37° 40' S. 177° 1' E.), 55 fms. Sandy mud. 4 specimens.

Little Barrier Isl.; 30 fms. Shells. 1 specimen.

2 miles E. of North Cape, 55 fms. Hard bottom. 1 specimen.

10 miles N.W. of Cape Maria v. Diemen, 50 fms. Hard bottom. Some small specimens.

Off Three Kings Isl., 65 fms. Hard bottom. 5 specimens.

This species was hitherto known only from the coast at Wellington, where Farquhar collected some specimens under stones, near low-water mark. Although I have been collecting at the same place and also in other places of the New Zealand coast in the littoral region, I have not come across this species there. — It is interesting that it has now been proved to be rather widely distributed in the seas off the North Island of New Zealand, in depths until at least 55 fathoms.

The specimens on which Clark had to base his description being quite young, it will be necessary to give some additional

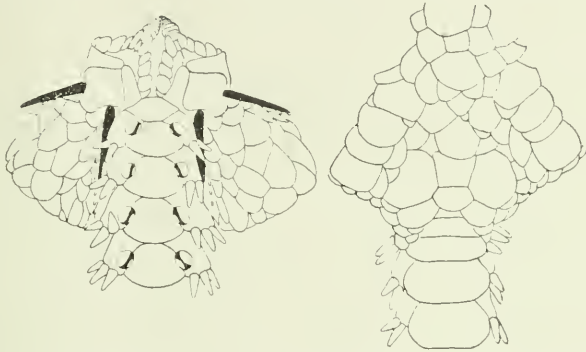


Fig. 32. *Ophiozonoida picta* H. L. Clark. Part of oral and dorsal side.  $\frac{6}{1}$ .

remarks on the characters of this species as shown by the adult specimens (Fig. 32).

The larger of the specimens before me measure 10 mm diameter of disk, the arms, which are rather thick and stiff being ca. 30 mm long. Disk covered with somewhat thickened scales, among which the primary plates remain more or less distinct, according to the varying size of the smaller secondary plates surrounding them. Generally there is a median series of 3—4 large plates in each interradius, but the series is sometimes indistinct, on account of smaller plates intruding among the larger ones. The small ovoid radial shields are widely separated by a series of three squarish plates, almost as large as the interradiial ones. Adjoining the distal one of this series is a slightly larger plate outside each radial shield, these three plates together forming a conspicuous band across the base of the arm. The dorsal plates are about twice as broad as

long, the outer edge arched with a slight concavity in the middle, made more conspicuous through the coloration, the notch itself being dark coloured, and the corners being white. They are broadly in contact almost to the end of the arm. The characters of the ventral side in the adult specimens do not differ essentially from those found in the young specimens; I must merely emphasize that the oral shields are not pentagonal, but have the outer sides

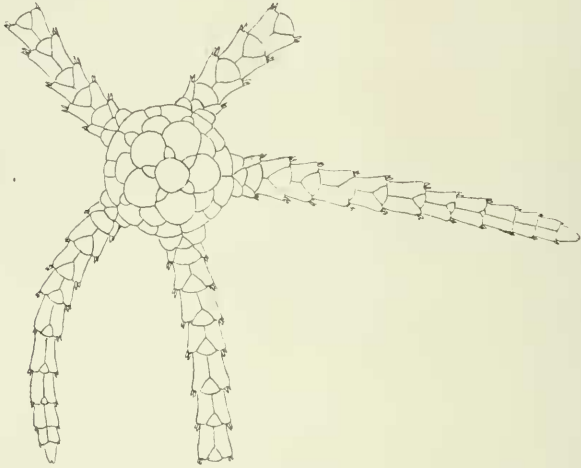


Fig. 33. *Ophiozonoida picta* H. L. Clark. Young specimen. <sup>12</sup>/<sub>1</sub>.

distinctly concave, the outer part thus being distinctly narrower than the inner part; they may be said to be almost spear-shaped. The madreporite alone retains the pentagonal shape. Also in younger specimens I find the oral shields more or less narrowed in their outer part, not so distinctly pentagonal as they are in the specimen figured by Clark (Op. cit. Pl. 18, fig. 4). The ventral plates are generally more or less distinctly brownish and thus form a continuous brownish median band, lined on both sides with white, viz. the side plates. The outer edge of the ventral plates sometimes appears to have two distinct small whitish spots; it is, however, the inner, adradial point of the sideplates, which is thus coloured. The tentacle scales are single, as stated by Clark; but in the larger specimens there may be a very distinct elevated rim along



the adradial side of the pore, which may convey the impression that there are two tentacle scales.

The genital slits are narrow, not reaching beyond the second armjoint; an indication of papillæ along their edges. The teeth are strong, broad, squarish, six in each column. The mouth-structure upon the whole rather robust, recalling that of *Ophiopholis*.

In the larger specimens it is not rare to find some of the dorsal armplates divided in two lateral halves through an oblique median line. — In a very young specimen, only 1.5 mm diameter of disk (Fig. 33), the primary plates are very prominent, the secondary plates have just made their appearance, viz. 5 interradial ones, adjoining the corners of the central plate, and 5 radial ones (or rather 3, the fourth and fifth having not yet appeared) beginning to separate the radial shields, which are still almost completely contiguous. The plate outside each radial shield has already appeared and is, on account of its white colour, very conspicuous. They very much give the impression of representing the side armplates corresponding to the inner dorsal plate. This, however, they do not, the side plates proper of this joint lying wholly on the oral side. It is a noteworthy fact that the arms of the young specimens may be of unequal length (Fig. 33). The coloration of the disk plates in the young specimen — brown, with the distal part white — makes them very conspicuous.

The Ophiurid which Bell (Op. cit.) mentions as *Pectinura* sp. I have had the opportunity of examining in the British Museum. There is no doubt that it belongs to the present species.

Also in this species the eggs are rather large and yolky, which fact tends to indicate that it has, probably, direct development, without a pelagic larva of the typical Ophiopluteus-form.

### 38. *Ophioplocus Huttoni* Farquhar.

Fig. 34.

*Ophioplocus Huttoni*. H. Farquhar. 1899. Description of a new Ophiuran. Proc. Linn. Soc. N. S. Wales. p. 187. Pl. XV.

— — H. L. Clark. 1915. Catalogue Recent Ophiurans, p. 344.

Slipper Island; under stones, at low water. 1 specimen.

North Cape; under stones, at low water. 1 specimen.

To the careful description of this species given by Farquhar I shall only add that in the larger specimen before me (8 mm diameter of disk) the shape of the ventral plates is somewhat different from that shown in Farquhar's figure, these plates being more broadly in contact than there (Fig. 34). The difference is simply due to age. In the second specimen before me (5 mm diameter of disk) the ventral plates have exactly the shape given in

Farquhar's figure (from a specimen 6 mm diameter of disk.)

It may also be pointed out that the genital slits are very short, reaching from close by the oral shield to the end of the second armjoint; in the smaller specimen they are still shorter, not reaching beyond the first armjoint.

The species was known hitherto only from the coast off Wellington. It has now been shown to occur along the East coast of the North Island of New Zealand up

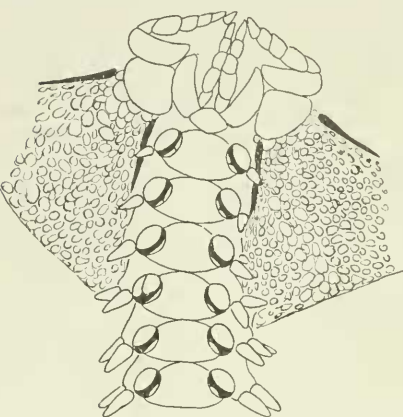


Fig. 34. *Ophioplocus Huttoni* Farquhar.  
Part of oral side. 12/1.

to the northern end, and most probably it will thus prove to occur along the whole coast of the North Island.

From the other species of *Ophioplocus* hitherto described it is easily distinguished through its single tentacle papilla (the semi-circular rim along the outer side of the tentacle pore is found also in the other species) and through the armspines being only two.

### 39. *Pectinura cylindrica* (Hutton).

Figs. 35.1—2.

- |                             |   |
|-----------------------------|---|
| <i>Ophiura cylindrica</i> . | Hutton. 1872. Catalogue Ech. New Zealand. p. 3.<br>Descr. new Starfish from N. Zealand. P. Z. S p. 811.                             |
| <i>Ophiopeza</i> —          | Farquhar. 1895. Notes on some New Zealand<br>Echinoderms. Trans. N. Z. Inst. XXVII. p. 198.   |
| — —                         | Farquhar. 1897. A Contribution to the History of<br>N. Z. Echinoderms. Journ. Linn. Soc. Zool. XXVI.<br>p. 190. Pl. XIV. figs. 4—5. |
| — —                         | Farquhar. 1898. On the Echinoderm Fauna of N. Z.<br>Proc. Linn. Soc. N.S. W. p. 306   |

- Pectinura cylindrica*. H. L. Clark. 1909. Notes on some Australian and Indo-Pacific Echinoderms. Bull. Mus. Comp. Zool. LII. p. 117.
- — H. L. Clark. 1915. Catalogue of Recent Ophiurans. Mem. Mus. Comp. Zool. XXV. p. 303.

Some few specimens of this species were taken at Mahia Peninsula, under stones at low water (18/XII.14). Further, a single, very young specimen was taken at the Three Kings Isl., in a depth of 65 fathoms, 5/I.15, and must undoubtedly belong to this species. — Some remarks on the characters which distinguish this species from *Pectinura gracilis* are given under the latter species.

40. *Pectinura gracilis* n. sp.

Figs. 35.3—5; Fig. 36.

Paterson Inlet, Stewart Isl., 5—15 fms; mud bottom; 17/IX.14. A few specimens.

Queen Charlotte Sound, 3—10 fms. 20/I.15. 2 specimens.

Three Kings Isl., ca. 65 fms. 5/I.15. 1 specimen.

Diameter of disk of largest specimen 8 mm; arms 3 times the diameter of disk, slender and very flexible. Disk, as usually in this genus, completely covered with fine grains. Mouth papillæ as in *P. cylindrica*, but the oral shields distinctly smaller than in that species (Figs. 35.1, 3.). Supplementary plate generally distinct, semi-circular. Ventral plates about as long as broad, sometimes with a small keel in the proximal part. No grooves between the inner ventral plates. Two tentacular scales of the typical shape and arrangement. Dorsal plates fanshaped, only slightly broader than long; the inner one, following the one or two rudimentary plates within the notch at the armbasis, almost semilunar. Armspines 6, rarely 7 (on a few of the proximal armjoints); they are rather slender, about half the length of the side plate. — Colour of disk and arms almost black, the arms somewhat banded with white.

In some of the larger specimens a few of the dorsal plates in the proximal part of the arm have a somewhat different shape, the outer corners being somewhat rounded truncate. This character I find more pronounced in the two specimens from Queen Charlotte Sound (Fig. 35.5). These specimens otherwise agree so completely

with those from Stewart Isl. (— excepting only that the coloration is somewhat lighter —) that there can be no doubt but that they must be referred to the same species.

More doubtful is the specimen dredged at Three Kings Isl., ca. 65 fathoms (5/1.15). In this specimen the dorsal plates are broader, more angular than in the type, as seen from a comparison

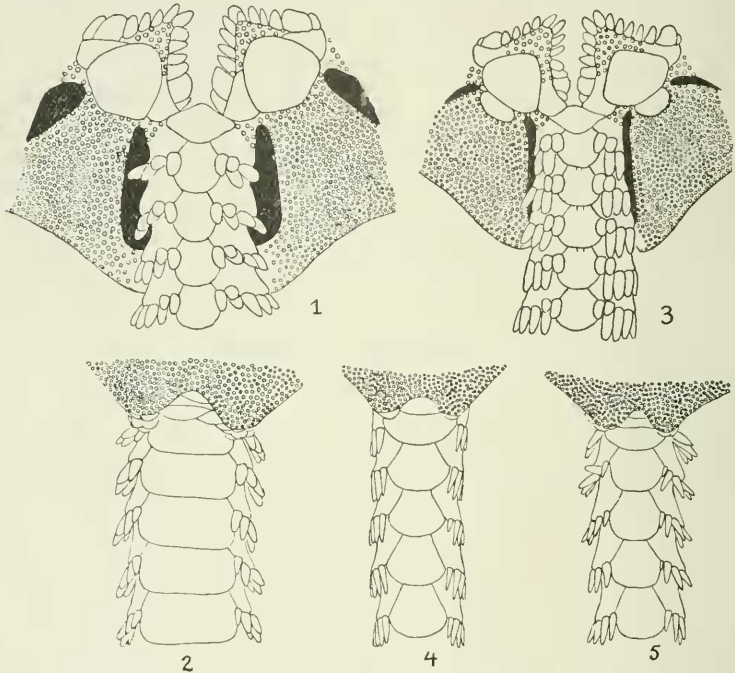


Fig. 35. *Pectinura cylindrica* Hutton (1-2); *Pectinura gracilis* Mrtsn. (3-5). — 1 and 3. part of oral side; 2, 4 and 5. base of arm, dorsal side, with part of the disk. <sup>10</sup>/<sub>1</sub>.

of fig. 36 with fig. 35.3-5. Also the oral shields are more rounded, and the colour is much lighter, nearly white. Whether these differences indicate this form to be a separate species or only a variety of *P. gracilis* cannot, of course, be decided from the single specimen in hand. For the present I must simply refer it to *P. gracilis*; but if the characters pointed out prove to be constant, I should think it a distinct species.

From *Pectinura cylindrica* the present species is very well distinguished, especially through the character of the dorsal plates,

which are twice as broad as long in the said species (Comp. figs. 35.1-2 and 3-5). The oral shields are much larger, and the space covered with grains inside the oral shields smaller than in *P. gracilis*. Also the spines are shorter and more flattened in *cylindrica*. The ventral plates do not present marked differences in the two species. Finally it would appear that *P. cylindrica* grows to a somewhat larger size than *P. gracilis*. The figures of the two species were drawn from specimens of nearly the same size in order to eliminate differences solely due to age.

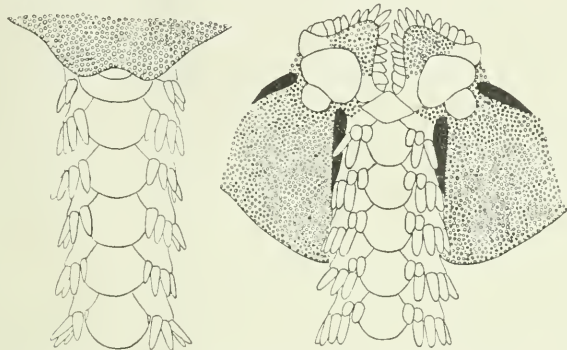


Fig. 36. *Pectinura gracilis* Mrtsn.; specimen from Three Kings Isl. Part of oral side, and base of arm, dorsal side, with part of the disk.  $\frac{10}{1}$ .

The two species appear to have the same distribution along the Northern coasts of New Zealand, from Three Kings Island to Cooks Strait. Whether this holds good also for the Southern coasts is still uncertain; only *P. gracilis* has been recorded from Stewart Isl. and thus evidently is distributed all along the coasts of the South Island. Recently I received from Prof. Benham some specimens of "*P. cylindrica*" from Stewart Isl.; they proved, however, to be *P. gracilis*. The facts at present available would thus seem to indicate that *P. cylindrica* does not extend so far South as *P. gracilis*.

After the above was written I received from Mr. W. R. B. Oliver a specimen stated to be the type of Hutton's *Ophiura cylindrica*. There is no doubt but that this specimen belongs to the species described here as *P. gracilis*, not to the one here named *Pectinura cylindrica* (Hutton) in accordance with the figures and description of the latter, given by Farquhar (Op. cit.). According

to this, the two names should be interchanged. This does not, however, seem to me desirable or necessary. On the board, which carries the name *Ophiura cylindrica*, two specimens have been mounted. Only one of these is left. I cannot help suggesting that the two specimens may have been one of each of the two species here mentioned, because of a discrepancy in Hutton's description. The colour given by Hutton decidedly agrees far better with the form here mentioned as *P. cylindrica* than with *P. gracilis*; on the other hand, the shape of the dorsal plates — "convex on the outer edge, and tapering inwards, nearly as long as broad" is in conformity with *P. gracilis*, not with the *P. cylindrica* of Farquhar and later authors. — In view of these facts, and as nothing at all is gained by the changing of the names, only a considerable confusion certain to arise from this change, I think it the best course to keep the name *Pectinura cylindrica* (Hutton) for the species figured and described under this name by Farquhar.

#### 41. *Pectinura maculata* (Verrill).

- Pectinura maculata*. H. Farquhar. 1898. Echinoderm Fauna of New Zealand. Proc. Linn. Soc. N. S. W. p. 306. (References to previous literature given here).
- — R. Koehler. 1907. Revision de la coll. des Ophiures du Mus. d'hist. nat. Paris. Bull. Sci. Fr. et Belgique. XLI. p. 285. Pl. X.<sub>3-4</sub>.
- — H. L. Clark. 1909. Notes on some Australian and Indo-Pacific Echinoderms. Bull. Mus. Comp. Zool. LII. p. 118.
- — H. L. Clark. 1915. Catalogue Rec. Ophiurans. p. 303.

Of this large and magnificent species several specimens were taken in Queen Charlotte Sound, 3—10 fathoms, 19/1.1915.

Further a few specimens were dredged in Paterson Inlet and in Halfmoon Bay, Stewart Island in 5—15 fms, in November 1914.

One of the specimens from Queen Charlotte Sound is 4-rayed. — In the only young specimen in hand (9 mm diameter of disk) the grooves between the first and the second ventral plate are not to be observed; in the larger specimens they are always distinct, though their entrance may be reduced to a mere narrow slit.

I find the eggs of this species fairly large and yolky, which would appear to indicate that its larva does not assume the typical Pluteus-shape.

## Explanation of the Plates.

## PI. III.

*Ophiocreas longipes* n. sp. Natural size.

## PI. IV.

- Fig. 1. *Gorgonocephalus chilensis* Phil., var. *novae-zelandiae* n. var.  
 — 2. *Astrotoma Waitei* Benham. Type-specimen.  
 — 3. *Astroceras elegans* Bell; two specimens with arms interlaced; one from the oral, the other from the aboral side.  
 — 4—5. *Ophiocreas constrictum* Farquhar, young specimen; 4. from the oral, 5. from the aboral side. (The specimen named as *Ophiomyxa brevissima* in Bell's Report).  
 — 6—7. *Astrotoma Benhami* Bell; 6. oral side; 7. aboral side.  
 — 8—9. *Astroporpa Wilsoni* Bell; 8 oral side; 9. aboral side.

All figures natural size.

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26—6—1924.